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ABSTRACT

The report presents a cost-benefit analysis on the removal of architectural barriers from residential and nonresidential buildings according to specifications being developed for approval by the American National Standards Institute. Economic benefits and costs are discussed for the following types of buildings: residential housing (highrise facility for the elderly and a single family, detached unit); educational and associated facilities (a college classroom building and a college dormitory); recreational/municipal facilities (a convention/exhibition center); and an extended commercial facility (a retail shopping center). An introductory section contains a summary of information on handicapped individuals in the United States and their general characteristics. (CL)

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A Cost-Benefit Analysis of Accessibility

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The research and studies forming the basis for this report were conducted by Syracuse University pursuant to a contract with the U.S. Department of Housing and Urban Development (HUD) Office of Policy Development and Research. The statements and conclusions contained herein are those of the contractor and do not necessarily reflect the views of the U.S. Government in general or HUD in particular. Neither the United States nor HUD makes any warranty, expressed or implied, or assumes responsibility for the accuracy or completeness of the information herein.

FOREWORD

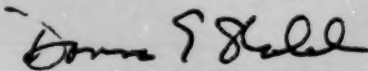
Over the last decades, Americans have been learning to see what we have never seen before. I refer not to flying saucers but to people -- people who have been hidden from us by prejudice, by custom, and by ignorance. Ralph Ellison described the phenomenon for blacks in his powerful novel, The Invisible Man.

Today, finally, we see the black population; we are only beginning to see other groups -- women, the American Indian, the elderly, the handicapped -- see them both as national resources and as groups having claims on the national conscience.

This publication is one of a series of six, the titles of which are listed in the acknowledgements, that HUD's Office of Policy Development and Research has sponsored to accomplish the important task of making buildings accessible to and usable by the physically handicapped through improving the American National Standards Institute's A117 standard.

Prepared under the supervision of the Office of Policy Development and Research, these volumes have won a research award from Progressive Architecture. To quote from the jury comments: "In terms of the effect that the work will have on future architecture and planning, the new ANSI standard A117.7 has got to be the blockbuster of all.....It's a very solid piece of work."

It is indeed. I am proud to present it to you.


Donna E. Shalala
Assistant Secretary
for Policy Development
and Research

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This report is one of a series of reports prepared under this contract. The full series includes:

1. Access to the Built Environment: A Review of Literature
2. Accessible Buildings for People with Walking and Reaching Limitations
3. Accessible Buildings for People with Severe Visual Impairments
4. The Estimated Cost of Accessible Buildings
5. A Cost-Benefit Analysis of Accessibility
6. Adaptable Dwellings

All of this research contributed to the development of the proposed revisions to ANSI A117.1, Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped.

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Executive Summary

1

Executive Summary

This report presents a cost-benefit analysis on the removal of architectural barriers from residential and nonresidential buildings according to specifications being developed for approval by the American National Standards Institute, ANSI A117.1 (1978), Specifications for Making Buildings Accessible to and Usable by Physically Handicapped People.

The study is limited to nine case study buildings on which cost estimates for elimination of architectural barriers in accordance with the proposed ANSI A117.1 (1978) have been developed. Data limitations precluded an analysis of costs and benefits to all building construction at a national level. The analysis here, therefore, must be viewed as illustrative and cannot be generalized beyond the specific types of buildings chosen as case study projects. The actual cost estimates for these buildings, a description of the buildings, the extent of barrier elimination, and the methodology used to develop cost estimates is found in a companion report (Schroeder, et al., 1978).

This study is restricted to easily measurable economic costs and benefits. The economic costs and benefits associated with barrier elimination may be public (benefits or costs accruing to persons other than handicapped individuals) or private (benefits or costs accruing to the handicapped individual). Estimating public benefits usually requires an extensive analysis beyond the scope of this study; as a result, only private benefits are estimated here.

The estimation of private benefits is generally intended to reflect the greater productivity and/or welfare of handicapped people due to the removal of architectural barriers. The private benefits estimated may include saved costs (due to the individual's greater ability to care for himself) as well as increased spending activity (due to the individual being newly able to engage in purchasing activity). Social benefits and costs, such as unemployment from the displacement of existing services (e.g. institutional care) are not considered. Finally, only initial investment costs for making buildings accessible are recognized. Private costs to handicapped individuals associated with the use of accessible buildings (e.g. transportation costs) as well as additional maintenance costs and depreciation are assumed to be negligible, and have not been included.

The estimated beneficiary population of handicapped people is based on demographic data describing the extent of disability in the U.S. population and in three selected case study cities: one large (Buffalo), one medium (Syracuse), and one small (Utica) in population size. Expected beneficiaries are, by assumption, restricted to those whose severity of disability would preclude their use of buildings prior to barrier elimination. Accordingly, adjustments were made to demographic data to include only those who are severely disabled.

Benefits are estimated for each case study building separately, based on the size of the beneficiary population, the specific type of benefits that would accrue due to the building's particular use, and a 50-year utilization of buildings. For the building types studied, the benefits are:

1. Residential (3 types) - reduced cost for personal care service due to increased independence in living arrangement.
2. College classroom - increased earnings due to a college education.
3. College dormitory - savings in living expenses.
4. Convention/exhibition center - increased revenues due to increased use.
5. Retail shopping center - increased revenues.
6. Public municipal buildings (town hall and branch library) - no easily measured economic benefits could be identified.

Economic benefits from employment opportunities for handicapped workers are not considered in the analysis. It is expected that the skill levels of handicapped persons, hiring attitudes of employers, and the nature of affirmative action plans would be significant factors in the employment of handicapped persons in accessible buildings. Accessibility to buildings alone is not sufficient reason to expect that the employment of handicapped individuals in those buildings would take place. A more detailed analysis of employment potential is beyond the scope of this study.

The extent to which the measured benefits would be realized is modified by the expected utilization rates of buildings by handicapped persons wherever data were available to make reasonable assumptions. Benefits that would be realized over a series of years in the future are discounted to a present value figure by an estimated rate of return to alternative investment opportunities. Estimates of benefits for each case study building are calculated as if the building were to be placed in each of the case study cities or in a "national average" locality.

The cost estimates of eliminating architectural barriers through renovation and redesign are adjusted, by construction cost indices, to each of the case study cities and the national average. The cost estimates are then compared with benefits to obtain two measures:

1. Benefits net of costs, and
2. A ratio of estimated benefits to costs.

The findings are that, for those buildings to which easily estimated economic benefits could accrue, benefits are almost always much higher than costs (ranging from seven to several thousand times the level estimated costs). Although the study is necessarily limited in many respects, the degree to which benefits outweigh costs is so high that the magnitude of allowable error in the estimation of benefits is usually at least 90 percent, and in no case less than 80 percent. That is, a correction in the estimation of benefits that would reduce them by 80 percent would still, in no case, bring measured benefits below costs. Although allowable error is phrased with respect to measured benefits, the margin between benefits and costs would of course allow considerable underestimation of costs as well.

Caution should be used in generalizing from this study to all buildings and building types. As was discovered with two of the case study buildings,

readily identifiable economic benefits do not always exist. In such cases, a cost-effectiveness approach may be used to establish the economic worth of eliminating architectural barriers by comparing costs of elimination with other methods of providing services. Moreover, it is ultimately the social impact of eliminating architectural barriers that must be used as a basis for making a decision on whether or not architectural barriers should be eliminated. These economic measures are not offered as an adequate description of social impact. An analysis of economic costs and benefits is useful, however, in placing the economic aspects of such decisions in perspective.

Introduction

2

Introduction

Cost-benefit analysis is the comparison of the expected time-stream of costs and the expected time-stream of benefits associated with a proposed project or program -- developed as a method for selling public investment priorities according to their economic merit. An immediate problem in applying cost-benefit analysis to a specific situation is that of accurately measuring costs and benefits -- in particular, social costs and benefits as opposed to private costs and benefits, and noneconomics benefits as opposed to economic benefits. These problems of measurement have generated a pragmatic, problem-oriented literature surrounding cost benefit analysis, dealing with measurement and other problems on a case-by-case basis.

The costs and benefits associated with the elimination of architectural barriers present considerable problems of measurement. The magnitude of these difficulties, however, does not diminish the appropriateness of cost-benefit analysis to the investment decision. The allocation of funds to improving the mobility of handicapped persons competes with all other conceivable allocations of those funds; cost-benefit analysis provides a framework for ranking barrier elimination among the array of alternative allocations.

Non-economic benefits from the construction or renovation of buildings to ensure accessibility by the handicapped -- such as the personal satisfaction of handicapped persons from greater independence -- are difficult to measure. Proxies for non-economic benefits, such as the utilization rate of a specific building must assume a level of satisfaction associated with a utilization episode. Because of their inexact content, such measures are not clearly comparable to measures of cost and provide no clear decision criterion based on the net merits of the proposed project.

The discussion of benefits and costs in the following sections, therefore, focuses on economic benefits and costs. Economic benefits and economic costs may be private (benefits or costs accruing to the handicapped individual) or public (benefits or costs accruing to persons other than the handicapped individual, including the population at large). Economic benefits are measured as either additional income or saved expenditure directly attributable to the physical accessibility of selected buildings to handicapped persons. In most cases, private economic benefits are easier to measure than public benefits. The measurement of social economic benefits, taking the form of increased income to persons other than the handicapped individual due to fuller or more efficient employment, requires an extensive analysis of economic interactions that is beyond the scope of this study.

In addition to the frequent exclusion of social benefits in the following discussion, only the investment costs of eliminating architectural barriers

from the selected buildings are considered. It is assumed that the private costs -- such as additional transportation expenses -- involved in utilizing the selected buildings are negligible, and that other social costs (such as displacement of resources due to self-provision of services that had been marketed, or the relative efficiency of self-provision) are likewise negligible. Specific problems of measurement and scope are discussed in detail in the following sections.

Section 3 contains a summary of available information on the handicapped population in the United States and a review of their general characteristics. Three areas of New York State -- Buffalo, Syracuse and Utica, New York -- were chosen for individual case studies of the benefits and costs of removing architectural barriers from the selected buildings. These particular areas were chosen to illustrate the potential diversity of findings depending on differences in the population size and composition of urban areas, even in a geographically compact region. The variation between the findings with respect to the case study areas and the national findings, further illustrates considerable regional variation in both costs and benefits. The characteristics of the handicapped populations in each case-study area are discussed also in Section 3. Section 4 includes a discussion of the buildings selected for the removal of architectural barriers, and reviews feasible methods for measuring the benefits expected to accrue from their modification. Section 4 also discusses the benefit measures calculated for the United States and the case study areas of Buffalo, Syracuse and Utica, New York. Expected utilization of the selected buildings in each area is discussed in the context of their current utilization rate, and general estimates of expected benefits are presented. Estimates of the cost of removing architectural barriers from the selected buildings are presented in Section 5. These costs are estimated as a national average and for each case study area, alternately for redesigning a planned structure and for renovating an existing one. A comparison of benefits to costs, an analysis of allowable error consistent with the decision criterion being unchanged, and a review of data constraints are presented in Section 6.

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The Handicapped Population

The Handicapped Population in the United States

A. Sources of Data

The sources of information on the nature and prevalence of disability in the United States are the National Health Interview Survey (1963-), the 1970 Census, the Social Security Surveys of Noninstitutionalized and Institutionalized Adults (1966 and 1967, respectively). Each survey represents a different population group over a different time span, and identified disability in a different context.

The National Health Interview Survey (NHIS), conducted by the National Center for Health Statistics, annually interviews a consistent population sample of approximately 42 thousand households, comprising 134 thousand individuals.¹ These households are selected from the civilian, noninstitutionalized population of the United States and cover all age groups. The survey questions focus on the individual's medical condition and health-service utilization to establish the prevalence of diseases and impairments, the extent of disability, and the volume and kinds of medical, dental and hospital care received. The extent of activity limitations is explored if a chronic condition, impairment (a physiological or anatomical loss or other abnormality) or acute condition is reported to be of longer than three months duration. Activity limitations are defined as limitations in the amount or kind of work (including housework) that the individual considers himself capable of performing. The sample is re-interviewed annually. A core of questions regarding the individual's health status and health service utilization during the preceding year is repeated. Questions regarding the individual's socio-economic adjustment to disability may change annually or are asked at intervals greater than one year.

The United States Census, conducted by the U.S. Bureau of the Census every ten years, focuses on the measurement of labor force characteristics and participation. Disability is considered in the census only when the respondent is out of the labor force. Alternative reasons for not working or for not seeking employment are "keeping house, going to school, retired, or unable to find work." The census, as does the NHIS, covers the entire noninstitutionalized population between sixteen and sixty-four years of age. Persons who are classified as disabled must (1) be unable to do any kind of work, (2) be "suffering from a definite illness or disability of longer duration and sufficiently serious to prevent working," and (3) must not be expected to be able to return to work within six months.² Within this classification, the nature or severity of the disability is unidentified.

Because the NHIS and the census define disability by different criteria (the ability to do housework represents a major discrepancy in definition, distorting prevalence estimates particularly within the female population), their measures of disability prevalence are difficult

to compare. The NHIS reported approximately 1.5 million noninstitutionalized persons aged 17 to 64 unable to work or to keep house during 1963 - 1965. This figure represents 1.4 percent of the 105 million persons in the United States' noninstitutionalized population in that age group.³ The NHIS further estimated that an additional 7.5 million persons aged 17 to 64 were able to work during the period 1963-1965, but were limited in the amount or kind of work of which they considered themselves capable.^{4,5} The NHIS may, however, understate the prevalence of severe disability in the noninstitutionalized population:⁶ the census reported approximately two million persons aged 20 to 62 (a more restricted age range than that employed by NHIS) who had not worked throughout 1965 due to illness or disability.⁷

The Social Security Surveys of Institutionalized and Noninstitutionalized Adults include the United States' population between the ages of 18 and 64, within and outside of, respectively, institutionalized living arrangements. Because the evaluation of building-utilization by handicapped persons refers primarily to the activity of non-institutionalized, ambulatory persons, the Survey of Institutionalized Adults is not presented here.⁸

The Social Security Survey of Noninstitutionalized Adults (SSN) contains data collected in personal interviews with 8700 disabled adults; 30 thousand households were screened by mail questionnaire to identify the persons interviewed. The SSN questions focus on the social and economic effects of disability. Like the NHIS, the SSN establishes the health status of the individual in terms of a specific medical problem. Activity limitations, however, are recorded in far more detail, dealing not only with work limitations but also with the inability to perform specific physical movements. Disability is categorized as "severe," and "occupational," or as a "secondary work limitation," depending upon the individual's response to a series of questions about labor force activity. Disabled adults unable to work regularly or at all are classified as severely disabled. Disabled adults able to work only part-time or unable to perform the same work as prior to the onset of their disability are classified as occupationally disabled. Respondents who were (1) limited in either the kind or amount of work they could do and (2) able to work full-time, regularly and at the same work as prior to the onset of disability (or were unemployed prior to the onset of disability), are classified as having a secondary work limitation.⁹ An overview of the characteristics of disabled persons reported by the SSN is presented in the following section.

B. Characteristics of the Handicapped Population in the United States

Disability has been defined in the preceding section as the inability to perform usual activities. In order to differentiate the severity of disability, the data sets described above use limitations on labor activity as a proxy for limitations on all activity, including activities such as personal maintenance and recreation.

The population to be examined in this study is not defined as necessarily physically limited in their work activity, but as having an impairment, a loss of function that may or may not have resulted in work-related disability. The available data, however (in particular, the 1966 Social Security Survey of Noninstitutionalized Adults on which the following discussion is based), exclude those individuals for whom impairment did not lead to work-related disability, but may nevertheless have affected personal care or recreational activities. To the extent that these persons would benefit from eased assessability of buildings, the following discussion understates the number of potential beneficiaries in the United States.

The individuals included in the Social Security Survey were, in 1966, limited in the amount or kind of work (or housework) of which they were capable. Moreover, these limitations must have resulted from a chronic health condition or impairment of at least three months duration.¹⁰ The data presented below refer to the civilian noninstitutionalized population disabled longer than six months at the time of the Survey.

Limitations in the capacity of the disabled population identified in the Social Security Survey to perform specific physical activities are summarized in Table 1. Seventy-one percent of the total disabled population indicated limited ability to perform at least one of the specified activities (stooping, lifting, using stairs, walking, or using one or both hands). Only 24 percent of the total disabled population, however, reported both physical activity limitations and that they required help for personal care (dressing, personal hygiene or eating) or for mobility (leaving their bed or home). Well over one half of the persons stating both physical activity limitations and that they needed help for personal care or mobility were also classified as severely disabled. These persons comprised slightly less than 9 percent of disabled persons identified by the Social Security Survey and 1.5 percent of the total noninstitutionalized population of the United States in 1966.

It is assumed in the following estimation of benefits that handicapped persons are precluded from the use of the specified buildings prior to their architectural modification and able to utilize them at the same rate as non-handicapped persons after their modification. Because of the rigidity of this assumption, the largest proportion of the beneficiary population aged 18 to 64 is considered to be those people who are identified as severely disabled as well as both limited in their ability to perform specific physical activities and requiring help for personal care. The beneficiary population selected by

Table 1: Physical Activity Limitations: Number and Percent Distribution of Disabled Adults Aged 18 to 64 and Prevalence Rates by Severity, 1966

Physical Activity Limitation	Number (in 1,000's)	Percent of Total Disabled	Prevalence Rate ¹	Needs Help For Personal Care or Mobility ²			Prevalence Rate
				Number (in 1,000's)	Percent of Margin Total	Percent of Total Disabled	
Total Disabled:							
Total	17,753	100.0	166.2	2,878	16.2	16.2	26.9
No limitations in specified activities	5,184	29.2	48.5	498	9.6	2.8	4.7
Limitations in stooping, lifting using stairs	5,716	32.2	53.5	1,373	13.8	7.7	12.9
Limitations in walking, or unable to use one or both hands	4,243	23.9	39.7				
Both walking and manual limitations	2,610	14.7	24.4	1,007	38.6	5.7	9.4
Total - limitations in specified activities	12,569	70.8	117.7	2,380	23.9	13.4	22.3

¹Number of disabled adults per 1,000 noninstitutionalized civilian U.S. population aged 18 to 64, March 1966.

²Personal care activities includes dressing, personal hygiene and eating. Mobility is defined as the ability to transport oneself and the ability to go outside the home.

Note: Tables may not add due to rounding error in reproducing original data from published percentage figures. Source: Compiled from L.D. Haber, "The Epidemiology of Disability: II. The Measurement of Functional Capacity Limitations," Social Security Survey of the Disabled: 1966, Report No. 10 (July 1970) Tables 1 and 2.

Table 2: Physical Activity Limitations: Number and Percent Distribution of Disabled Adults Aged 18 to 64 and Prevalence Rates by Severity, 1966

Physical Activity Limitation	Number (in 1,000's)	Percent of Total Disabled	Prevalence Rate	Needs Help For Personal Care or Mobility			Prevalence Rate
				Number (in 1,000's)	Percent of Margin Total	Percent of Total Disabled	
Severely Disabled:							
Total	6,099	34.4	57.1	1,807	29.6	10.2	16.9
No limitations in specified activities	1,030	5.8	9.6	238	23.1	1.3	2.2
Limitations in stooping, lifting using stairs	1,827	10.3	17.1	806	22.8	4.5	7.5
Limitations in walking, or un- able to use one or both hands	1,709	9.6	16.0				
Both walking and manual limitations	1,533	8.6	14.4	760	49.6	4.3	7.1
Total- limitations in specified activities	5,069	28.6	47.5	1,566	30.9	8.8	14.7

Table 3: Physical Activity Limitations: Number and Percent Distribution of Disabled Adults Aged 18 to 24 and Prevalence Rates by Severity, 1966

Physical Activity Limitation	Number (in 1,000's)	Percent of Total Disabled	Prevalence Rate	Needs Help For Personal Care or Mobility			
				Number (in 1,000's)	Percent of Margin Total	Percent of Total Disabled	Prevalence Rate
<u>Other Disabled:</u>							
Total	11,654	65.6	109.1	1,071	9.2	6.0	10.0
No limitations in specified activities	4,154	23.4	38.9	260	6.3	1.5	2.4
Limitations in stooping, lifting using stairs	3,889	21.9	36.4	567	8.8	3.2	5.3
Limitations in walking, or un- able to use one or both hands	2,534	14.3	23.7				
Both walking and manual lim- itations	1,077	6.1	10.1	247	22.9	1.4	2.3
Total - limitations in specified activities	7,500	42.2	70.2	814	10.9	4.6	7.6

these criteria may include persons who are so severely disabled that they are unable to function independently even in architecturally adapted surroundings. Likewise, disabled persons who may be able to cope with architectural barriers, but would nevertheless benefit from their removal are excluded. These errors are to some extent self-cancelling but there is no good way to arrive at an estimate of the residual error from published data.

The 8.8 percent of the total disabled population identified by the Social Security Survey as severely disabled and requiring help for personal care or mobility do not include visually handicapped persons who are able to perform the activities specified, but would nevertheless benefit from the removal of architectural barriers. Almost 36 percent of the 433 thousand persons reporting visual impairments as their major disabling condition in 1966 were classified as severely disabled by the Survey.¹¹ The requirements of visually impaired persons for help in personal care or mobility are not published. It is assumed, however, that all persons who are categorized as severely disabled with visual impairment as their major disabling condition would benefit from the removal of architectural barriers.¹² The inclusion of severely disabled persons whose principal disabling condition is visual impairment results in an addition of 155 thousand persons nationally to the expected 1966 beneficiary population, raising the total number of persons 18 to 64 years of age expected to benefit from the removal of architectural barriers to 1.72 million persons in 1966, or 1.7 percent of the 1966 U.S. population in that age group.

Changes in behavior among disabled persons 18 to 64 after the onset of disability are recorded in Table 4. No evaluation of these figures by functional limitation is possible from published data. The activities presented in Table 4 were chosen as relevant to the particular buildings selected for study - specifically, commercial and recreational facilities. The data suggest that the onset of disability may reduce shopping activity outside the home by only 35 percent. Among those for whom shopping and social activity outside the home were customary prior to disability, almost 60 percent stated that they engaged in those activities as much or more after becoming disabled. Among severely disabled persons, 35 percent stated that they shopped as much or more after the onset of disability; 26 percent engaged in social activity outside the home either as much or more than prior to disability. No information on behavior changes relative to customary activity among severely disabled persons is available from published data.

Within the total disabled population, men tended to maintain or increase participation in both activities more often than women if they had customarily participated prior to being disabled. Nevertheless, men are nine times more

Table 4: Shopping and Social Activity Outside the Home by Extent of Participation and Sex: Percentage Distribution of Disabled Adults¹ Aged 18 to 64, 1966

Extent of Participation	Shopping		Social Activities Outside Home	
	Total Disabled	Customary Activity ²	Total Disabled	Customary Activity
Number (in thousands)	15,035	12,600	15,035	12,149
Total percent	100.0	100.0	100.0	100.0
Do as much or more	50.0	59.7	45.6	56.4
Do less	25.2	30.1	21.6	26.7
Stopped	8.6	10.3	13.6	16.8
Never did	14.9	--	12.4	--
Not reported	1.3	--	1.5	--
Number-men (in thousands)	7,061	4,985	7,061	5,861
Number-women (in thousands)	7,974	7,614	7,974	7,089
Ratio: Total men/total/women	0.886	0.655	0.886	0.827

Probability Ratio: Men/Women³

Do as much or more	0.799	1.081	1.087	1.164
Do less	0.638	0.863	0.734	0.786
Stopped	0.717	0.970	0.895	--
Never did	9.097	--	1.653	--
Not reported	0.857	--	0.875	--

Severely Disabled Persons

Number (in thousands)	6099	--	6099	--
Do as much or more	34.7	--	26.3	--
Ratio: Men/Women	0.6049	--	0.6049	--
Do as much or more	0.7467	--	0.6970	--

¹ Excludes persons disabled before age 18.

² Disabled persons who implied that shopping and social activity outside the home, respectively, were customary prior to disability, i.e., those stated maintained or increased activity, reduced activity, or stopped activity.

³ Male participants per male disabled population divided by female participants per female population. A value of 1 indicates equal probability of men and women to participate as indicated.

Source: Computed from L.D. Haber. "The Epidemiology of Disability: II. The Measurement of Functional Capacity Limitations," Social Security Survey of the Disabled: 1966, Report Number 10 (July 1970), Table 11.

likely not to, and never to have done shopping on a regular basis at all, and almost twice as likely not to, and never have engaged in outside social activity. Among severely disabled persons, men were less likely than women to maintain or increase participation after disability. Again, this behavior is not standardized with respect to customary activity prior to disability among severely disabled persons.

The behavior summarized in Table 4 suggests that an assumption that architectural barriers preclude the utilization of public buildings may be quite restrictive, even among severely disabled persons. Adjustments for sex, age, and economic status may be useful in refining estimates of utilization changes due to the accessibility of specific buildings. Published data, however, do not allow the matching of participation behavior to the physical activity limitations identified in Table 1, so that refinements of the expected utilization pattern after accessibility are not within the scope of this study.

Because the Social Security Survey included only persons between the ages of 18 and 64 years of age, the beneficiary population estimated above must be expanded to include persons under 18 or over 64 who would be likely to benefit from the removal of architectural barriers.

An estimate of the prevalence of mobility - restrictive chronic conditions among persons under 17 years of age can be obtained from the National Health Interview Survey (NHIS) taken in 1972. Although the NHIS seems to understate disabled persons 17 to 64 years of age relative to both the Census and the Social Security Survey estimates, there is some evidence that the NHIS estimates are reliable for persons under 17 years of age.¹³

The size and distribution of the U.S. population under 17 among categories describing mobility limitations are presented in Table 5. Only three persons per thousand population in this age category reported mobility limitations in 1972. Only slightly more than one person per thousand indicated that they needed either personal or mechanical help for mobility. Males under the age of 17 reported mobility limitations proportionally more often than females of comparable age. Persons in the Northeast region - including New York State - reported fewer mobility limitations per capita than persons under 17 in other parts of the United States. Residents of Standard Metropolitan Statistical Areas, moreover, reported proportionally fewer mobility limitations than their counterparts residing outside

Table 5: Prevalence Rates Of Mobility Limitations Among the 1972 US Population Under 17 Years of Age by Sex and Location

Characteristic	Population under 17 years (in 1,000's)	% of population with no mobility limitations	Percentage of Population With Mobility Limitations			
			Total	Trouble getting around alone	Needs help getting around	Confined to house
Total	64,865	99.70	0.30	0.11	0.13	0.06
Sex						
Male	33,037	99.68	0.32	0.11	*	*
Female	31,027	99.73		0.17	*	*
Region						
Northeast	14,334	99.76	0.24	*	*	*
North Central	18,270	99.74	0.26	*	*	*
South	20,645	99.62	0.38	*	*	*
West	11,616	99.72	0.28	*	*	*
Place of Residence						
All SMSA's	40,855	99.72	0.28	0.10	0.13	*
Central City	16,801	99.69	0.31	*	*	*
Outside						
Central City	24,054	99.74	0.26	*	*	*
Outside SMSA	24,010	99.68	0.32	*	*	*
Non-farm	21,405	99.64	0.36	*	*	*
Farm	2,605	100.00	--	--	--	--

* Less than 0.05 per cent

Source: National Center for Health Statistics (USDHEW), Limitations of Activity and Mobility Due to Chronic Conditions: U.S. - 1972, Series 10, Number 96 (Washington, D.C. USGPO, November 1974), Tables 2, 18 and 21.

an SMSA, on a farm or otherwise. Young persons residing in an SMSA, but outside the center city - the largest block of young persons by residence - reported fewer mobility limitations per capita than persons in any other residence classification. Because of the relatively low rate of mobility limitation among young persons outside the central city, inclusion of these persons in the calculation benefits from the removal of architectural barriers will produce a higher estimate of absolute benefits but a lower level of benefits per total population than would be arrived at by basing benefit estimates on the projected utilization of persons residing only in the central city.

Among persons under 17 reporting mobility limitations, 69.4 percent indicated that the chronic conditions causing limited mobility had persisted for over one year (see Table 6). Noting the duration of the condition is important in maintaining the comparability of persons in the under 17 age group to those aged 18 to 64, identified in the SSN survey. Due to the relatively small number of persons in this age group reporting mobility limitations, the duration of the condition producing the individual mobility limitations specified in Table 6 is indeterminate.

The number of persons under 18 years of age expected to benefit from the removal of architectural barriers in 1972 is calculated as the proportion of persons under the age of 17 who reported mobility limitations (0.3 percent) multiplied by the proportion of those persons reporting mobility limitations persisting at least one year (69.4 percent) multiplied by the proportion of the population under 17 years that reported the need for help (either personal or mechanical) in moving about (0.13 percent). That fraction, 0.0003 percent, is multiplied by the number of persons in the United States under age 18 in 1972 to arrive at an estimate of the beneficiary population under 18 years of age. This method was chosen to conform as closely as possible to the criteria by which persons 18 to 64 years of age were selected as likely beneficiaries. The prevalence of chronic conditions affecting mobility of persons under seventeen is ascribed to the population under 18 (persons over the age of seventeen were aggregated in published NHIS data in the 17-44 age grouping, as opposed to the Social Security grouping of ages 18-44, but this is not expected to be a source of significant error. Changes in the beneficiary population under the age of 18 are estimated by multiplying the constant prevalence rate of mobility limitations, multiplied by the absolute change in the base population under 18 years of age.

Table 6: Duration of Chronic Conditions Among Persons Under 17 and Over 64 Years of Age by Mobility Limitation, 1972

Mobility Limitation	Total	Under 17 Years of Age				Total**	Over 64 Years of Age			
		% less than 1 year	% 1-4 years	% 5 years or more	% over 1 year		% less than 1 year	% 1-4 years	% 5 years or more	% over 1 year
All	193	*	41.45	27.98	69.43	3505	8.39	40.80	40.14	80.94
Has trouble getting around alone.	73	*	*	*	--	1151	6.17	43.18	37.88	81.06
Needs help getting around.	83	*	*	*	--	1327	8.82	40.02	39.49	79.50
Confined to the house.	37	*	*	*	--	1027	10.32	39.14	43.52	82.67

* Less than 0.05 per cent

** Includes duration unknown

Source: National Center for Health Statistics (USDHEW), Limitations of Activity, and Mobility due to Chronic Conditions United States - 1972 Series 10, Number 96 (Washington, D.C.: USGPO, November 1974), Table 26.

Table 7: Prevalence Rates of Mobility Limitations Among the 1972 US Population Over 64 Years of Age by Sex and Location

Characteristic	Population over 65 (in 1,000's)	% of population with no mobility limitations	Percentage of Population With Mobility Limitations			
			Total	Trouble getting around alone	Needs help getting around	Confined to house
Total	19,924	82.41	17.59	5.78	6.66	5.15
Sex						
Male	8,301	83.76	16.23	5.37	5.95	4.90
Female	11,623	81.43	18.57	6.07	7.17	5.33
Region						
Northeast	5,184	83.53	16.47	4.51	6.02	5.94
North Central	5,507	84.23	15.76	5.21	6.86	3.69
South	6,137	78.75	21.25	7.82	7.04	6.39
West	3,095	84.56	15.44	4.85	6.62	3.97
Place of Residence						
All SMSA's	12,207	83.61	16.43	4.96	6.15	5.32
Central City	6,469	82.55	17.45	5.27	6.29	5.89
Outside Central City	5,738	84.77	15.23	4.60	5.94	4.69
Outside SMSA	7,716					
Non-farm	6,813	80.48	19.52	7.22	7.46	4.84
Farm	903	80.95	19.05	5.98	7.86	5.20

Source: National Center for Health Statistics (U.S.D.H.E.W.), Limitations of Activity and Mobility due to Chronic Conditions: United States - 1972. Series 10, Number 96 (Washington, D.C.: USGPO, November 1974), Tables 2, 16, and 21.

The prevalence of chronic impairments leading to mobility limitations among persons over 64 years of age is estimated in the same way as mobility limitations were estimated among persons under 18 years of age. The NHIS data are a unique source of information on persons over age 65, so that there is no evidence as to the reliability of the NHIS figures in this age group comparable to the checks from alternative data sets available for persons under 18 or persons aged 18-64.

Table 7 summarizes the distribution of persons over age 64 in 1972 reporting mobility limitation as the result of a chronic condition. Almost 18 percent of the population over the age of 64 in 1972 reported mobility limitation. Almost half of these persons (6.7 percent of all persons over 64 years old) indicated that they needed either personal or mechanical help for mobility. Women comprised well over one half of the elderly population in 1972, and reported mobility limitations proportionately more often than men. The distribution of men and women reporting mobility limitations is roughly comparable over severity categories.

Elderly persons in the Northeast - including New York State - reported mobility limitations more frequently than their counterparts in the North central or Western Regions of the United States, but considerably less often than elderly persons in the South. The relative frequency of severe limitations (needing help for mobility or confined to the house) among persons in the Northeast, however, is noticeably higher than among elderly persons in other regions of the United States.

The largest single bloc of elderly persons in 1972 were non-farm residents living outside an SMSA, presumably in smaller urban areas. This group reported the highest rate of mobility limitations among the elderly population, but a relatively low rate of house confinement. Aggregating residents of central cities and those of the immediate suburbs, however, well over one half of the elderly population resided within an SMSA. The severity pattern of persons residing in the central city and reporting mobility limitations is similar to that exhibited by SMSA residents outside the central city. The largest proportion of these persons (approximately 6 percent) required some help for mobility.

Among elderly persons reporting activity limitations in 1972, almost 81 percent indicated a related chronic condition having persisted in excess of one year (see Table 6). This fraction did not differ significantly over severity levels.

The number of elderly persons likely to benefit from the removal of architectural barriers in 1972 is estimated as the proportion of that population reporting mobility limitations such that they required help in getting about (5.78 percent), adjusted for the percentage of those persons whose

chronic condition had persisted in excess of one year (79.5%), and multiplied by the number of persons over 64 years of age in 1972 adjusted prevalence rate (4.6 percent). Again, refinements of this study might include adjustments for sex and location that are impossible from published data.

Summary

The magnitude of the population expected to benefit from the eased accessibility of public buildings is estimated by age category because of the necessity of merging two data sources. The largest bloc of probable beneficiaries (aged 18 to 64) is estimated from data collected by the 1966 Social Security Survey of Noninstitutionalized Adults (SSN). Probable beneficiaries under the age of 18 are estimated from data describing individuals under the age of 17, collected by the National Health Interview Survey (NHIS). An estimate of probable beneficiaries aged 17 is extrapolated from the percentage figures describing the population under 17 years of age in the NHIS. Probable beneficiaries over the age of 64 are also identified by NHIS data.

Beneficiaries in each age category are computed as a percentage of the total (disabled and non-disabled) population in the respective age group reporting that they required help for mobility due to a chronic condition having persisted for at least six months (for persons aged 18 to 64) or one year (for persons under 18 or over 64). Estimated beneficiaries in the 18 to 64 age group are further constrained to persons identified by the SSN as severely disabled. Finally, severely disabled persons reporting visual impairment (but may report no mobility limitation) are added to the expected beneficiaries aged 18 to 64. The inclusion of persons reporting visual impairment and classified by the SSN as severely disabled introduces the possibility of double-counting, but this problem is small. These percentage figures by age group are summarized below in Table 8. The absolute number of beneficiaries in any year is computed as the percentage figure by age category reported in Table 8 multiplied by the total population (disabled and non-disabled) in that age group in that year.

It is expected that the prevalence figures by age group computed in this way generally understates the beneficiary population by eliminating persons whose disability is less severe, but would nevertheless benefit from the eased accessibility of buildings. The group selected is, however, expected to conform to the rigid assumption of no utilization prior to the removal of architectural barriers. It may, however, overstate the population expected to utilize buildings normally after the removal of barriers.

Table 8: Estimated Prevalence of Persons Expected to Benefit
from the Removal of Architectural Barriers by Age:
U.S. Average

Age Category	Persons per 100 Population
Under 18	0.0003
18 - 64	1.69
Over 64	4.60

Table 9: Characteristics of the Noninstitutionalized Population Aged 16 to 24 with Work Disability¹ and Relationship to Total Population, 1970: Buffalo, Syracuse and Utica-Rome SMSA's

<u>Buffalo SMSA</u> (total 1970 pop.: 800,750)				<u>Syracuse SMSA</u> (total 1970 pop.: 375,255)				<u>Utica-Rome SMSA</u> (total 1970 pop.: 198,231)			
	Total Disabled	% of Total Disabled	Probability Ratio: ² Total Pop. by Characteristic	Total Disabled	% of Total Disabled	Probability Ratio: Total Pop. by Characteristic	Total Disabled	% of Total Disabled	Probability Ratio: Total Pop. by Characteristic	Total Disabled	% of Total Disabled
Total	69,101	100.0	.0813	31,634	100.0	.0843	17,664	100.0	.0892		
Sex											
Male	33,969	52.2	1.10	16,929	53.5	1.10	9,769	55.2	1.13		
Female	31,132	47.8	0.91	14,705	46.5	0.91	7,915	44.8	0.88		
Race											
Black	8,389	12.9	1.72	---	---	---	---	---	---		
Non-black	56,712	87.1	0.94	---	---	---	---	---	---		
Yrs. of School Completed:											
Elementary											
Less than 8	13,270	20.3	1.72	4,811	15.2	1.62	3,487	19.7	1.47		
8	10,327	15.9	1.28	3,678	11.6	1.12	2,864	16.2	1.20		
High School											
1 - 3	17,313	26.6	1.10	8,552	27.0	1.26	4,719	26.7	1.19		
4	15,251	23.4	0.75	9,316	29.5	0.88	4,402	24.9	0.76		
College											
1 - 3	5,713	8.8	0.77	3,149	10.0	0.75	1,511	8.5	0.78		
4+	3,227	5.0	0.58	2,123	6.7	0.59	701	4.0	0.52		
Income											
None	13,688	21.0	---	6,366	20.1	---	3,654	20.7	---		
With Income ³	51,413	79.0	---	25,268	79.9	---	14,030	79.3	---		
Less than \$1,000	8,238	(16.0) ⁴	2.67	3,910	(15.5)	1.70	2,302	(16.4)	2.69		
\$1,000-1,999	10,226	(19.9)	2.76	3,985	(15.7)	1.91	2,528	(18.0)	2.31		
\$2,000-2,999	5,452	(10.6)	1.94	3,139	(12.4)	2.25	1,935	(13.8)	2.42		
\$3,000-4,999	7,720	(15.0)	1.60	4,151	(16.4)	1.67	2,231	(15.9)	1.47		
\$5,000-6,999	6,532	(12.7)	1.25	3,563	(14.1)	1.31	2,058	(14.7)	1.15		
\$7,000+	13,225	(25.7)	0.42	6,518	(25.8)	0.46	2,976	(21.2)	0.37		
Labor Force Status											
Unable to Work	27,671	42.5	---	11,539	36.5	---	7,392	41.8	---		
Able to Work	37,430	57.5	---	20,095	63.5	---	10,292	58.2	---		
In Labor Force	27,442	(73.5) ⁵	1.07	15,018	(74.7)	1.09	7,848	(76.3)	1.07		
Employed	25,680	(93.6)	0.99	14,143	(94.2)	0.99	7,368	(93.9)	0.99		

¹ Work disability having persisted 6 months or more.

² The probability ratio is computed as the percentage of the disabled population having a particular characteristic (sex, race, education, etc.) per the percentage of the total area population having that characteristic.

³ Includes wage and salary income, farm and non-farm net self-employment income, Social Security or railroad retirement income, public assistance or welfare income, and all other income.

⁴ Percentages in parentheses indicate the proportion of persons in that income category who declared some positive income or a loss in 1969. The probability ratios, then, are computed only over persons who declared a positive income or loss, and do not include persons declaring no income in 1969.

⁵ Percentages in parentheses computed over only persons who reported the ability to work. Probability ratios were computed correspondingly.

Source: U.S. Bureau of the Census, Census of Population, 1970, "Characteristics of the Population", Part 34, New York Section 2 Washington, D.C.: U.S.G.P.O., 1973, Table 169.

Characteristics of Handicapped Persons in the Case Study Areas

A brief economic description of the disabled population of Buffalo, Syracuse, and Utica, New York can be compiled from the Current Population Survey conducted by the U.S. Bureau of the Census in 1970. Information on the prevalence and nature of specific impairments among the population is not available from either the Social Security Survey of the National Health Interview Survey in geographic detail sufficient to describe persons with mobility limitations by Standard Metropolitan Statistical Area (commonly abbreviated SMSA). The New York State Department of Vocational Rehabilitation was contacted as a possible source of information on disabled persons by county in New York State. The nature of the data collected by DVR, however, made them an unreliable basis for analysis.

Table 9 summarizes the economic characteristics of persons in the Buffalo, Syracuse and Utica SMSA's who reported work disability having persisted at least six months at the time of the 1970 Census. The population described in Table 9 include persons 16 to 64 years of age; persons under 16 or over 65 years old are not identified in Census data by SMSA. Furthermore, because the Census published only economic characteristics of persons reporting persistent work disability, no indication of the prevalence of mobility or self-care limitations among these persons is available.

In each SMSA, between 8 and 9 percent of the total population aged 16-64 reported persistent work disability. This number is far below the 17 percent national average identified by the Social Security Survey, and fewer than the 12 percent national average reporting mobility or personal care limitations. Disabled persons in each of the three SMSA's were more likely than the total population to be male (indicated by a probability ratio greater than one). This pattern was particularly pronounced in Utica, where the number of males per the disabled population in 1970 was 13 percent greater than the total number of males per the total SMSA population.

Racial characteristics of disabled persons were unavailable for the Syracuse and Utica SMSA's from published Census data. Disabled persons in the Buffalo SMSA were more likely to be black than was the general population. Disabled persons in all three SMSA's were less likely to be high school graduates or to have completed any formal education beyond high school than was the general population, and approximately half as likely to have completed four or more years of college.

The income distribution reported among disabled persons varied distinctly from that reported by the total population of each area. Disabled persons in Buffalo, Syracuse and Utica were more likely than the total populations in each area to have had an income less than 3,000 dollars in 1969, and less than half likely to have had an income exceeding 7,000 dollars in that year. Income differences between the disabled and total population were more pronounced in the Utica SMSA and less pronounced in the Syracuse SMSA.

The labor force participation rate among disabled persons able to work is slightly higher (7-9 percent) than the labor force participation rate among the total populations in all three SMSA's. The employment rate among disabled persons able to work, however, was slightly less than that experienced by the total population in each area.

In summary, the most striking differentials between the disabled and total populations in each SMSA occurred in the education and income characteristics of the populations. A strong racial bias - indicating a considerably higher percentage of blacks among the disabled population than among the total population - was discernable from data available on the Buffalo SMSA.

Because the Census data do not indicate the extent to which handicapped persons in the Buffalo, Syracuse and Utica SMSA's are limited in either mobility or their ability to care for themselves, the NHIS national prevalence estimates of self-care and mobility limitations are used to estimate the local populations with mobility and/or self care limitations. The national prevalence estimates of persons under 17 years of age or over 65 with mobility limitations, residing in an SMSA in 1972 are adapted to estimate the corresponding populations in the Buffalo, Syracuse and Utica-Rome SMSA's. In 1972, 0.13 percent of the national population under 17 years of age and residing in an SMSA reported mobility problems such that they needed help in getting about (Table 5). Among these persons under seventeen, 69.43 percent reported that the condition which had caused a mobility problem had persisted at least one year (Table 6). The proportion of persons under 17 years of age who can be identified as both chronically impaired and limited in mobility, therefore, is equal to 0.09 percent (0.13×69.43). That figure is applied to estimates of the populations under 18 years of age in each year to arrive at an annual estimate of the beneficiary population under 18 years of age in each SMSA.

The number of persons 18-64 years of age in each area who are expected to benefit from the removal of architectural barriers is estimated as the rate reported by the Social Security Survey at which persons severely disabled for longer than six months needed help for personal care or mobility (Table 1). That rate (1.69 percent of the national population aged 18-64) is applied to the estimated total populations of that age in each SMSA by year to produce an estimate of the annual beneficiary population aged 18-64 in each area.

Finally, the number of persons aged 65 and over expected to benefit, is estimated as the NHIS prevalence estimate of persons over 64 years of age living in an SMSA requiring help for mobility (6.15 percent) in 1972 (Table 7). This is adjusted by the percentage of persons in that category who reported a related chronic condition having persisted at least one year (79.5 percent, Table 6). The adjusted figure (4.9 percent) is used as the rate at which the total populations over age 65 in Buffalo, Syracuse and Utica would benefit from the removal of architectural barriers.

Table 10: Estimated Prevalence of Persons Expected to Benefit
from the Removal of Architectural Barriers by Age:
Buffalo, Syracuse and Utica-Rome SMSA's

Age Category	Persons per 100 Population
Under 18	0.09
18 - 64	1.69
Over 64	4.89

The results of each of these estimates over specified age groups in each area are summed within areas to arrive at the total number of persons in each SMSA over all ages that would benefit per year from the accessibility of the selected buildings.

Summary

The prevalence estimates among the population of the Buffalo, Syracuse and Utica-Rome SMSA's are adapted from the national prevalence estimates reported by the 1966 Social Security Survey of Noninstitutionalized Adults (SSN) for the population aged 18 to 64, and from the 1972 National Health Interview Survey (NHIS) for the population aged under 18 or over 64. It is expected that these figures are more useful than the 1970 Census estimates for those SMSA's in arriving at an estimate of the disabled population that is consistent with the criteria defining the disabled population nationally. It should be noted that the SSN and NHIS estimated prevalence rates are considerably higher than either the national or area estimates produced by the Census.

We adopted the SMSA prevalence rates estimated by NHIS to arrive at estimates of the area beneficiary population under 18 or over 64. Because the prevalence rates within SMSA's are slightly higher than total prevalence rates over all locations, the rates used to produce area estimates of the populations under 18 or over 65 are slightly higher than the rates used to produce estimates of the national population in those age categories.

Benefit Estimation

4

Buildings Selected for Architectural Modification: Benefit Estimation

The buildings selected for adaptation to regular use by the handicapped are specific model structures, selected only to provide a explicit basis for analysis. They include residential housing facilities (a 200-unit highrise housing facility for the elderly, and a 2,050 square foot, single family, detached housing unit), educational and associated facilities (a 58,700 square foot college classroom building and a 550 bed college dormitory), recreational/municipal facilities (a conventional/exhibition center - including a 13,500 seat arena and 396,500 square feet of exhibition halls, a 1200 square foot public branch library, and a 42,850 square foot town hall), and an extended commercial facility (a 202,800 foot retail shopping center). Benefits derived from greater accessibility of these buildings vary considerably among building types. A common assumption throughout the following study, however, is that handicapped persons are precluded from the utilization of these buildings in the same manner as the population at large after their modification. It is further assumed that among the building types selected, all such buildings in the area are to be made equally and simultaneously accessible to the handicapped so that there is no redistribution of normal utilization patterns by persons substituting against comparable, but unmodified buildings. Finally, it is assumed that architecturally adapted buildings incur no net maintenance cost or saving, and uniformly have an expected useful life of 50 years.¹⁴

The employment of handicapped individuals in these buildings was not included as an economic benefit from the removal of architectural barriers. An analysis of employment opportunities afforded by the accessibility of commercial buildings would include the study of:

1. The employable skills of handicapped individuals.
2. The attitudes of employers toward hiring handicapped individuals of different skills and different impairments.
3. The reduction in public transfers to newly employed, handicapped individuals.

The scope of such a study would be beyond that of the study undertaken here. Although such an analysis may yield significant benefits aggregated to the national level, it is doubtful that any single building would provide significant employment opportunities.

A. Low and High-Rise Housing for the Elderly and Single Family Dwellings

The economic benefit derivable from housing adapted for use by elderly or by handicapped persons may be measured as the value of personal services that individuals are able to provide for themselves in the absence of architectural barriers. An estimate of the monthly value of personal care services is obtained by subtracting the average rental price of residential facilities which provide no personal services to tenants from the average rental price of residential facilities that do provide personal care services to tenants (a category of residential facilities including, primarily, health-related facilities). The difference between the average monthly charge of each residence type is used to arrive at an annual estimate of the average market value of personal care services. It is assumed that the monthly price difference between residential facilities offering no personal care services and those providing personal care services is attributable only to the market value of those services, and that only one person per unit has replaced purchased personal care services by self-provided services.^{15,16} Additionally, it is assumed that housing from which architectural barriers have been removed, rents at the same price as comparable, unmodified housing and that the construction of barrier-free housing has no effect on average rental prices or land values in the area. That is, it is assumed that the individual does not pay a rent premium that would diminish the net value of self-provided services. Finally, it is assumed that the average vacancy rate in each area (the average probability of any unit being unoccupied per year) is the vacancy rate to be experienced in the modified housing.

There are several possible sources of error in this estimation procedure: (1) it is expected that senility is a common malady among elderly persons currently residing in proprietary homes and health-related facilities. It is unrealistic to expect that senile persons would be able to function independently only by providing an environment that compensates for physical mobility limitations. The estimate of benefits is therefore adjusted downward by 20 per cent each year to reflect the approximate proportion of persons living in health-related facilities who would be unable to utilize housing adapted to mobility limitations.¹⁷ That is, it is assumed that persons utilizing barrier-free housing would still purchase twenty per cent of all personal care services they consume at market prices. (2) It is assumed that the resources currently devoted to the provision of personal care services are employed at their opportunity wage and are costlessly transferable to employment elsewhere at the same wage and total productivity. That is, the advent of self-provided personal services results in a net increase in total productivity by the value of those services. This assumption eliminates the possibility of a social cost from the displacement of employed resources. (3) The assumption that architecturally-adapted housing will rent at the same price as non-specialized

housing by broad geographic area undoubtedly introduces some distortion into the estimate of benefits by (a) assuming a variety of market similarities and adjustments and (b) averaging rental prices over an area which may demonstrate considerable variance in the price of housing. The magnitude or direction of the bias introduced by this assumption is uncertain. (4) The level of government subsidy to specialized housing (at the local, state or federal level) has been ignored in the estimation of benefits. An implicit assumption in the estimation procedure used is that the level and composition of government subsidies (and taxes) are unaffected by the redistribution of elderly persons between housing classifications and that there are no other net social benefits from the modification of housing for use by the elderly.¹⁸ (5) The assumption that the value of personal care services received by persons residing in a health-related facility approximates the value of care received by persons within a family unit averages personal care services over care needs that may be dissimilar and assumes that all providers of services are equally productive. The variance of need and productivity characteristics among consumers and providers, respectively, of personal care services, is unknown from published data.¹⁹ Again, neither the magnitude or direction of error introduced by an assumption of uniformity both among consumers and among providers of personal care services can be gauged by information available.

The cost of personal care services is estimated by separating out the personal care component in cost of nursing home prices. Such an estimate may over-represent the cost of caring for an individual below the average age of people living in nursing homes. For this reason, estimates of benefits from making single family housing accessible may be overstated for younger, handicapped people.

B. College Classroom Building

Economic benefits derivable from the accessibility of a classroom building are estimated as a proportion of the increased expected future earnings accruing to individuals as a result of higher education. The expected future earnings of an individual entering college are estimated as the average lifetime income of a college graduate adjusted for the average attrition of entering freshmen, the foregone earnings of college students in school, and the probability of unemployment among college graduates. Foregone earnings of college students in school are computed as the difference between the average annual income of persons 18 to 24 years of age with a high-school education, and the average annual income of persons 18 to 24 years of age with zero, one year, two years, and three years of college education, respectively, for four consecutive years, adjusted for the probability of attrition in each year.²⁰ The increase in future earnings of an individual is computed as the excess of the expected lifetime earnings of the individual entering college over the expected future earnings of a high-

school graduate over their respective lifetimes. In the absence of good information about the income composition of persons over 64 (so that labor and asset income can be distinguished from transfer income) the lifetime earnings of the individual are adjusted downward by the proportion of total income in each area that represented transfer income as opposed to labor or asset income. The number of persons able to benefit each year from the adaptation of a college classroom is estimated as the number of freshmen that could be accommodated by the 58,700 square-foot classroom building selected for modification. It is assumed that fifty classes of entering freshmen are accommodated by this building, and that the building is fully utilized.

Several sources of possible error in this estimation procedure can be identified: (1) The assumption that a cross-section income profile among persons of varying ages and levels of education are representative of one individual's experience through time is a common and major source of errors in estimating expected lifetime earnings. The error generated by this assumption, moreover, may be larger when the group under study (handicapped persons) is expected to have an atypical labor force experience. In the absence of time-series data on the earnings experience of educational cohorts, however, there is some evidence that total earnings would be understated in the individual's later years.²¹ (2) The assumption that individuals enter a four-year college at the age of eighteen although not severely restrictive for the total student population,²² may be quite restrictive with respect to handicapped persons, particularly if disability at age 18 was preceded by illness of some duration so the usual age-schooling correlation was disrupted. Use of this assumption may overestimate benefits by magnifying the period over which college-based income accrues. (3) The exclusion of the cost of tuition and other overt private expenses of attending school from the calculation of benefits accruing to the individual acknowledges the social benefits of an individual consuming the product of the educational sector. More specifically, expenditures on educational output are a negative item in the calculation of private benefits, but represent a positive social benefit. Assuming that the resources employed in education are employed in their most productive capacity, expenditures on educational production contribute to an efficient level and distribution of gross national income. If resources employed in all other sectors are also efficiently employed, alternative uses of the funds spent on education would be equally productive, and the net social benefits of expenditures on education are zero.

C. College Dormitory Building

The benefits derivable from the adaptation of a college dormitory for use by the handicapped may be estimated as saved expenditures of handicapped students on commercial housing in the area. To arrive at an estimate of total benefits, the excess of the average price of commercial housing (including room, board, books and supplies, transportation and personal expenses) over the price of dormitory housing per year person may be multiplied by

the ratio of the number of persons in the area who are both school-aged (18 to 22) and handicapped to the non-handicapped, school-aged population of the area; and by the 550-bed capacity of the selected dormitory.

This estimation procedure may include several sources of error. (1) It is assumed that transportation does not represent an exceptional barrier to handicapped persons using residential facilities other than dormitories. That is, it is assumed that the area's commercial housing is an accurate description of the student's alternatives for housing and that transportation expenses for handicapped and non-handicapped persons are identical.²³ If the handicapped student's college attendance is itself dependent on the student's residence in dormitory facilities, then the benefits derived from the modification of a dormitory to accommodate handicapped students are severely understated. A preliminary survey of students attending Syracuse University yields little evidence that the attendance of handicapped students is necessarily contingent on the accessibility of dormitory facilities (see Appendix 1). Lack of information about the specific handicaps of students enrolled in four-year colleges and those residing in campus housing precludes a more informed evaluation of this assumption.²⁴ (2) The relative efficiency of institution-provided board for students is overlooked by the estimation procedure. The net benefits of institution-provided board for students (in terms of cost-saving over private provision) is assumed to be negligible. There is no good information by which to assess the validity of this assumption. (3) It is implicitly assumed that an influx of handicapped students into the dormitory facility under study will neither displace non-handicapped students nor will it affect the price of dormitory housing. Otherwise stated, it is assumed that there is a vacancy rate in dormitory housing of adequate size to accommodate additional utilization by handicapped students and that the cost of accommodating an additional student is constant. (4) Finally, in the calculation of benefits from the modification of both the classroom building and the dormitory facility under study, it is assumed that the handicapped persons who reside in the area will utilize the buildings in the same proportion as all students utilize the buildings relative to the total local school-aged population. This method of estimation maintains a constant relationship between the student population and the total population of the area. There may be considerable variance in the mobility patterns of handicapped students as opposed to students with no handicaps. A more enlightened prediction of the mobility of handicapped students, however, is not within the scope of this study.

D. Convention/Exhibition Center

The benefits derivable from the adaptation of a convention/exhibition center for use by the handicapped are calculated as the change in gross revenues attributable to the greater access of the center to the handicapped population. Specifically, benefits per year are estimated as gross annual revenues multiplied by the ratio of handicapped to non-handicapped

persons residing in the area. This formulation is exactly that which would emerge from the adjustment of the utilization rate of handicapped persons for the utilization rate demonstrated by non-handicapped persons in the area.²⁵ The assumed life-span of the convention/exhibition center is again fifty years: gross revenues will be adjusted upward annually according to the average rate of growth of gross revenues experienced by a representative center in each study area between 1970 and 1975. For certain types of events (e.g. conventions where revenues represent a rental fee) the revenues received may underestimate the benefits received in the short run but, in the long run, price adjustments and/or increased utilization should restore total revenues as a good estimate of total benefits.

The dimensions of the convention/exhibition center chosen for study are considerable. No comparable building exists in any of the study area and few exist in the United States. Because of the rarity of centers of the specified dimensions, no national estimate of benefits will be calculated. Estimates of benefits due to the accessibility of buildings of a comparable nature, though smaller, are calculated in each of three case study areas.

E. Retail Shopping Center

The measurement of benefits from the adaptation of a shopping center involves, first, an assessment of the probable nature of a shopping center of the specified dimensions (regional, community or neighborhood)²⁶ and, second, attributing the average revenue experience of shopping centers of that general nature, by area and square foot of leasable space, to the center under study. Available data on shopping centers by general characteristics and size were collected by the Urban Land Institute in 1966 and 1969.²⁷ The average annual rate of change (including, implicitly, the rate of inflation of consumer prices) between these years will be used to project a value of gross revenues to 1975 and forward for fifty years - again, the assumed lifetime of the modified building. The increment in gross revenues per year attributable to the new accessibility of the shopping center to handicapped persons is calculated in the same manner as the increment in gross revenues projected for the convention/exhibition center: gross revenues per year are multiplied by the ratio of handicapped to non-handicapped persons in the area. Again, this formulation implicitly adjusts the projected utilization rate of the handicapped population in the area.

Sources of possible error in the estimation of benefits from the modification both of the convention/exhibition center and the shopping center are similar: (1) As indicated in Table 4, the utilization of recreation or shopping facilities among the handicapped population may not be that demonstrated by the non-handicapped population. Handicapped individuals may

have more time to utilize leisure-related facilities, or conversely, these persons may be prohibited from the use of leisure-related buildings by the nature of their disability, in spite of architectural modifications to accommodate them. (2) Projections of revenues based only on the extrapolation of time-series data may be quite inaccurate. Again, the scope of this study precludes a more sophisticated analysis of the determinants of revenue growth. (3) As in the treatment of benefits from the increased utilization of college dormitory space, it is assumed that the increased total utilization of both the convention/exhibition center and the shopping center in each study area does not raise the marginal cost (the difference in total cost between producing or not producing an additional unit of output) of accommodating these persons. This seems to be a feasible assumption in the case of facilities that already accommodate a large number of users.

F. Municipal Buildings: Town Hall and Public Branch Library

Finally, the economic benefits derivable from the adaptation of municipal buildings such as a town hall or public branch library are virtually impossible to measure. It is certainly possible that income benefits do derive from the availability of public records for inspection at a town hall or from the relatively low-cost entertainment in leisure hours afforded by a public library. The magnitude of these benefits varies greatly according to the motives and characteristics of the user, so that no statement about expected average benefits is feasible. It is, rather, more realistic to assume that the services represented by these buildings do yield benefits (both economic and non-economic) to the general public, including handicapped persons, and that these services are worth maintaining within some reasonable range of costs. The evaluation of the benefits from adapting a town hall or branch library to use by the handicapped will focus on this "reasonable" cost range. Alternatives to architectural modification of these buildings, including the feasibility of mailing or alternative delivery services, will be examined as potential sources of cost-savings. It is further recognized that the accessibility of buildings like the town hall or the public library may represent sources of considerable non-economic satisfaction to handicapped persons. The likelihood of non-economic benefits and the difficulty of measuring economic benefits recommend the use of a "cost-effectiveness" approach to the discussion of these buildings rather than the cost-benefits analysis applicable to commercial buildings.

Summary

The methods of measuring economic benefits from the modification of public and residential buildings for use by the handicapped vary con-

siderably among building types. Measurement of economic benefits generally involves a considerable number of assumptions to arrive at an expected experience. Common assumptions throughout the analysis include those about the utilization patterns of handicapped persons both before and after the architectural modification of the selected building, and those about the number of handicapped persons to be found among the population utilizing the building in future years. In general, it is assumed that the ratio of handicapped persons to non-handicapped persons in the resident population will remain constant over the projected lifetime of the building under study. A summary of the general sources of benefits from eased accessibility of commercial buildings is found in Table 11.

Measurement of benefits accruing from the modification of municipal buildings for use by the handicapped (specifically, the town hall and the public branch library) assume that the services offered by these buildings do yield both economic and non-economic benefits and are worth maintaining within some reasonable cost range. Alternatives to architectural modification are examined as potentially lower-cost modes of service delivery.

The following section estimates the benefits of adapting the buildings identified above for use by the handicapped. Estimates reflecting both a national average and an expected experience for the Buffalo, Syracuse and Utica-Rome SMSA's are presented. A national average benefit level from the accessibility of a convention/exhibition center is not calculated because of its unusually large size. Benefits expected to accrue from the accessibility of convention/exhibition centers of a size conformable to each case study area are, however, calculated and presented. Estimates of benefits derived from the accessibility of a town hall or branch public library (where utilization cannot be gauged by revenues or building capacity) are also omitted from this discussion, and a discussion of alternative costs (in the case of the public branch library) is substituted.

Table 11: Sources of Economic Benefits from the Removal of Architectural Barriers from Commercial Buildings

<u>Building Type</u>	<u>Sources of Economic Benefits</u>
Residential	Saved housing expense
College Classroom Building	Lifetime earnings associated with post-secondary education
College Dormitory Building	Saved housing expense
Convention/Exhibition Center	Additional gross revenues
Retail Shopping Center	Additional gross revenues

Economic Benefits from Access by the Handicapped: National Average and Area Estimates

Results reported here for estimated benefits have been discounted to present value figures. Benefit estimates are quite sensitive to the discount rate used. In this study, the rate selected was based upon the area to which the estimates applied; at the national level, a discount rate of 7 percent (interest rate) was used. At the local level, a 12 percent rate was generally used to reflect the level of economic activity in New York State, which seems to warrant a somewhat higher opportunity rate for invested capital. In the case of the college classroom, however, the national rate was retained for local estimates to reflect the high mobility of college students after graduation.

A. Low and High-Rise Housing for the Elderly and Single-Family Dwellings

The calculation of benefits from the removal of architectural barriers from housing for the elderly assumes that the proposed architectural modifications of housing enable individuals to increase the level of personal services they are able to provide themselves. This assumption defines a beneficiary population that would be independent within an environment which accommodates their physical limitations, but are presently purchasing personal care services in an institutionalized setting.

Existing specialized housing for the elderly is distinguishable into three general categories: (1) service-oriented housing (offering personal courtesies to residents such as scheduled group transportation, recreational programs and food-service programs); (2) health-related facilities (providing minimal nursing supervision, assistance with personal care and medication, some therapy services and central dining facilities); and (3) skilled nursing facilities (providing intensive medical services for long-term care or rehabilitation, assistance with personal care, cleaning and laundry service and central dining facilities.²⁸

Persons residing in service-oriented housing (congregate care facilities, rest homes for the elderly or domiciliary care units, for example) are usually able to live independently, but may require occasional assistance with special needs or services. Persons residing in health-related facilities (such as intermediate care facilities and skilled nursing facilities) are generally less self-reliant than persons living in service-oriented housing and typically require minimal but regular medical and/or personal services. Because the level of personal-care assistance provided in health-related facilities may be replaceable by self-provided care with the modification of the individual's physical environment, the valuation of personal services provided by health-related facilities is adopted as an approximation of the maximum economic benefit generated by barrier-free housing for the elderly.

The degree to which the replacement of institutionally-provided services by self-provided services as a feasible premise depends largely on the reasons for which services are required by individual in health-related facilities. It was suggested in Section A that the estimate of benefits from the architectural modification of housing to accomodate the elderly be adjusted downward by twenty percent to reflect the prevalence of senility among persons beyond the age of 64 living in institutional arrangements. If the distribution of senile persons among alternative institutional living arrangements is skewed toward the population residing in health-related facilities a twenty percent downward adjustment based on an average rate of senility across all institutional living arrangements may be quite modest. The same 20 percent downward adjustment is applied to the estimate of benefits generated by the removal of architectural barriers from a single-family dwelling. Because of the generalized population utilizing this housing, this adjustment is adopted as an arbitrary allowance for services that individuals are unable to provide for themselves even in an architecturally modified setting.

Because of the intensity and extent of medical services required by persons residing in skilled nursing facilities, such individual are not expected to comprise a likely beneficiary group, capable of living independently in architecturally-adapted housing. Valuing benefits at the market value of personal services provided to residents of skilled nursing facilities would overstate benefits by the value of personal services not feasibly self-provided.

Data published by the Public Health Service on charges for care in institutions for the aged and chronically ill in 1964 indicate a stable relationship across geographic regions between the average monthly charge for residence in a facility providing neither personal care nor nursing services (a service-oriented facility) and the average monthly charge for residence in a facility providing personal care services (a health-related facility) (see Table 12). By assuming that this relationship is constant for each region over time, the value of personal services can be specified as a constant proportion of the average monthly charge for residence in a health-related facility by area over the fifty-year assumed life of the building to arrive at the projected value of personal services in a health-related facility. This figure is adopted as an estimate of the total benefits accruing over fifty years from a single unit of barrier-free housing.

The average national monthly charge for residence in a health-related facility in 1975 is estimated from Public Health Survey data on the prices charged in facilities providing personal care services in 1968. The ratio of the national average price to the average price in New York State in 1968 was multiplied by the 1975 average monthly price of health-related facilities in Buffalo, Syracuse and Utica to arrive at an estimate of the national

Table 12: Estimated Monthly Value of Personal Care Services as a Percent of the Average Monthly Charge for Residence in a Health-Related Facility (HRF) in the U.S. by Geographic Region, May-June, 1964

Region	Average Monthly Charge for Residence in a Service-Oriented Facility (percent of average monthly charge in HRF)	Estimated Monthly Value of Personal Service Percent of Average Monthly Charge in HRF	t-Statistic ¹
All Regions	66.46	33.54	
Northeast	65.24	34.76	0.6070
North Central	65.73	34.27	0.3632
South	64.83	35.17	0.8109
West	69.19	30.81	1.3582

¹ The t-statistic represents a test of each sample mean against the population mean for significant difference. The critical value of t (two-tailed probability, 0.05 level of significance) with 4 degrees of freedom is 2.776. Insignificant t-statistics for all regions imply that use of the national ratio (33.54 percent) to arrive at an estimated value of personal care services should produce a valid national estimate with little variance across regions.

Source: Computed from U.S.D.H.E.W., Public Health Service, "Charges for Care in Institutions for the Aged and Chronically Ill, United States, May-June, 1964," Vital and Health Statistics, Series 12(9), August, 1967, p. 31.

average price in 1975. This estimated average national price was taken over the fifty-year expected life of the building according to the average compounded rate of growth of that price nationally between 1964 and 1968 as reported by the Public Health Survey. Because of the acceleration in the price of services nationally, it is expected that use of the 1964-1968 average rate will produce a conservative estimate of future benefits.

The average monthly charges for residence in health-related facilities in the Buffalo, Syracuse and Utica areas (in particular in Erie, Onondaga and Oneida counties) are computed from information released by the Onondaga County Department of Social Services. The average figures used were computed as the simple unweighted average of prices charged by health-related facilities in each of the three counties. These charges are brought forward over fifty years according to the average compounded rate of growth experienced by health-related facilities in the Northeast region between 1964 and 1968, as reported by the Public Health Survey. Again, because that rate of growth applied to the Public Health Survey rates published in 1968, there is some evidence that the time stream of future benefits estimated by that rate is conservative.

The rate at which the time stream of benefits over fifty years was discounted to a present value figure was 7 percent for the national estimate and 12 percent for the benefits estimated in New York State. The sum of discounted benefits over 50 years per unit of housing (again, assuming that low-rise, high-rise and single-family housing do not yield appreciably different benefits per unit) is presented in Table 13 by area. The estimated benefit level per unit is multiplied by the number of units to be architecturally modified to produce the total benefit estimate presented in Table 14.

B. College Classroom Building

The college classroom building identified for the removal of architectural barriers measures 58.7 thousand square feet. A 1960 survey of 1400 U.S. colleges and universities directed by the American Association of Collegiate Registrars and Admissions Officers indicated that the median floor space per full-time-equivalent student in general classroom space averaged 19.1 square feet. By that figure, it is projected that the model classroom building will accommodate approximately 3,073 full-time equivalent students per year. The product of the prevalence rate of chronic, mobility-restrictive impairments among the population aged 18-24 (approximated at 1.15 percent from published SSN data) and the number of full-time equivalent students accommodated per year by the specified classroom building (3,073) is used to estimate the number of persons benefitting from the removal of architectural barriers per year.

The income differential between persons 18-24 years of age having one-to-three years of post-secondary education and persons 18-24 years of age having a high school education is used to approximate the opportunity cost

Table 13: Estimated Discounted Benefits Per Unit of Housing Adapted
for use by Handicapped People, by Area, over Fifty Years

Area	Benefits per Unit (thousands of dollars)
U.S. Average	40.4
Buffalo Area	54.2
Syracuse Area	67.3
Utica Area	56.9

(that is the value of income that is forfeited in order to attend college) of attending college. This differential was accumulated over years according to the average rates of growth of each per-capita income figure between 1960 and 1970. The mean income differential between persons having completed four years of college and persons having completed high school by age category is used to approximate the economic benefits of post secondary education accruing over 52 years, the expected future life of an individual (averaged over sex and race) 18 years of age in 1975.²⁹

The mean income figures reported in the 1970 Census among individuals reporting income were reconstructed among all individuals by age category to reflect (within each age group) the probability of labor force participation and employment. By implicitly including these probabilities in the calculation of mean income, the rates of labor force participation and employment are held constant within age categories over the projected fifty-year life span of the classroom building. The mean-income differential, reconstructed over all individuals, is further adjusted downward (1) by the attrition rate of entering freshmen (53.3 percent nationally and 46.0 percent for SMSA's in New York State) and (2) by the proportion of income in 1969 that represented transfer income rather than earned income (24.5 percent nationally, and 16.1 percent, 12.4 percent and 12.2 percent in the Buffalo, Syracuse and Utica-Rome SMSA's, respectively). Finally, the differential income figures were again adjusted downward by the probability of death in any age group (again, averaged over sex and race). This downward adjustment ranged from 1.0 percent individuals aged 10 to 34, to slightly more than 19 percent for individuals beyond 65 years of age.

The benefits accruing to individuals from the first year of the building's life is calculated as the sum of the adjusted income differentials by age category over 52 consecutive years (that is, over the future life expectancy of an 18 year old individual, undifferentiated by sex or race, in the United States in 1975). Total benefits are calculated as the sum of these benefits generated by utilization of the building over 50 years. The total amount of benefits over individuals generated by the projected 50-year utilization of the building is discounted annually at seven per cent in all areas. The annual growth of mean per capita income is assumed to be the average compounded rate of growth experienced in each location between 1959 and 1969.

Estimates of the economic benefits accruing to individuals over the projected 50-year life of the specified college classroom building are presented in Table 15. It should be noted that the results reported in Table 15 are very sensitive to the discount rate selected: use of a seven per cent discount rate over the individual's projected earnings streams in the case-study areas raises the case-study estimates of cumulative earnings differentials considerably above the national average. Additionally, the depressed level of benefits in the case-study areas relative to the national averages are partially attributable to a low rate of growth in the average earnings differential between high school and college graduates in New York State relative to the growth of earnings differentials between these groups nationally.

Table 14: Estimated Total Benefit by Type of Housing Adapted for Use By Handicapped People, by Area (millions of dollars)

Housing Type	U.S. Average	Buffalo Area	Syracuse Area	Utica Area
High-Rise:				
200-units	8.08	10.84	13.46	11.38
100-units	4.04	5.42	6.73	5.69
20-units	0.81	1.08	1.34	1.14
10-units	0.40	0.54	0.67	0.57
Low-Rise:				
72-units	2.91	3.90	4.85	4.10
15-units	0.61	0.81	1.01	0.85
Single Family:				
1-unit	0.04	0.05	0.07	0.06

Table 15: Economic Benefits Generated by the Removal of Architectural Barriers from a 58,700 Square Foot College Classroom (thousands of dollars)

<u>Location</u>	<u>Average Cumulative Income Differential</u>
U.S.	\$ 17,796.6
Buffalo SMSA	13,318.4
Syracuse SMSA	12,645.7
Utica-Rome SMSA	14,530.7

C. College Dormitory Building

The estimation of economic benefits from the accessibility of college dormitory housing to handicapped students assumes that the decision of handicapped students to attend college is not premised on the availability of campus housing. A preliminary investigation of this assumption based on a count of Syracuse University students receiving financial aid from sources primarily committed to assisting the handicapped is provided in the Appendix to this report.

Table 16 compares the room, board and transportation expenses of commuter students and resident students in consecutive academic years 1971-1972 through 1975-1976. Assuming that the expense of books and supplies and personal items are comparable for both sets of students, annual rent, board and transportation expenses incurred by resident students have averaged in excess of \$300.00 above comparable expenses for commuter students in public institutions and almost \$500.00 above those expenses for commuter students in private institutions. It is expected that the smaller difference in the expenses of the resident over the commuter students in public vis-a-vis private institutions is at least partially due to housing subsidies in public institutions that lower the cost of campus housing to resident students in public institutions below the price of campus housing provided privately. To the extent that private institutions do not subsidize housing, the greater net expenses of resident over commuter students in private institutions is probably a more accurate reflection of market prices.³⁰

An estimate of economic benefits from the accessibility of college dormitory housing to handicapped students is not presented. Given the higher cost of on-campus living, no positive economic benefits are measured for making dormitories accessible in comparison to independent living in the community. Apparently, students live in dormitories for reasons other than the cost advantage in room, board and transportation. The unmeasured benefits of dormitory living (e.g. proximity, convenience, etc.) may be substantial for all students, and in particular, for disabled students, but are not measured by available data.

Room and board expenses for the academic year 1972-1973 in the Buffalo, Syracuse, and Utica areas are available from Barron's Profiles of American Colleges, and are presented in Table 17. Room and board expenses in the case study areas consistently exceeded average levels nationally by at least 14 per cent, somewhat higher than the ratio of the 1972 Consumer Price Index for housing expenses in the Northeast to the Index figure for housing expenses nationally. Although precise figures for commuter versus resident expenses are unavailable for the case study areas, there is no evidence that the computation of net economic benefits from the accessibility of dormitory housing to the handicapped would yield positive results.

Table 16: Room, Board and Other Expenses¹ for Commuters and Resident Students at Four-Year Institutions, US Average, Academic Years 1971-1972 through 1975-1976

Academic Year	Commuter Students		Resident Students		Estimated Net Rent, Board and Transportation Expenses (Commuter minus resident)	
	Public	Private	Public	Private	Public	Private
1971-72	\$ 1220	\$ 947	\$1436	\$ 1519	\$ -216	\$ -572
1972-73	1295	1020	1520	1555	-225	-535
1973-74	1277	1220	1744	1751	-467	-531
1974-75	1594	1603	1859	1959	-265	-356
1975-76	1688	1710	2101	2151	-413	-441
Mean	1415	1300	1732	1787	-317	-487

¹ Includes books and supplies, transportation and personal expenses.

Source: The Chronicle of Higher Education, Volume XII, Number 6 (April 5, 1976), p. 1.

Table 17: Average¹ Room and Board Charges in Public and Private Four-Year Institutions by Area as a Percent Average Room and Board Expensed Nationally, Academic Year 1972-1973

Area	Public Institutions (n) ^{2/}	Private Institutions (n)
Buffalo	114.68 (2)	117.71 (3)
Syracuse	-----	135.62 (2)
Utica	-----	114.86 (1)
U.S.	100.00 (--)	100.00 (--)

1. Computed as a simple average weighted by the number of full-time graduate and undergraduate students attending each institution in 1972-73.
2. Number of four-year institutions included in the average.

Source: Computed from: Barron's Educational Series, Inc., Barron's Profiles of American College, 9th Edition (Woodbury, N.Y., 1974); and The Chronicle of Higher Education, Volume XII, Number 6 (April 5, 1976), p.1.

D. Convention/Exhibition Center

The convention/exhibition center specified as a model for the removal of architectural barriers is much larger than those found in any of the case study areas. Exhibition space (not including seating area) in the model center is 4.5 times that of Buffalo's convention center (the largest among those located in the case study areas). Because convention/exhibition centers of the model's size are rare in the United States, no revenue experience can be identified as in any sense typical in order to project a national average level of benefits from accessibility. For this reason, national average benefits are not estimated. Area estimates of the economic benefits expected to accrue from the accessibility of the largest convention/exhibition centers in each area are estimated, however, and presented in Table 18.

These benefits are computed as the discounted sum of additional annual gross revenues attributable to the handicapped population in each area using the center at the same rate as the total population. Economic benefits are projected over 50 years (the assumed useful life of the building) and discounted annually at 12 per cent. Population growth is assumed to be the average annual rate of population growth by age category experienced in each area between 1960 and 1970. The relatively low estimate of benefits for the Syracuse area is primarily the result of the low average annual growth of total revenues experienced between 1970 and 1975. That rate of growth -- 5.9 per cent -- was approximately half the average annual growth experienced both in Buffalo and in the Utica area.

Table 18: Estimated Benefits from the Removal of Architectural Barriers from a Convention/Exhibition Center -- Buffalo, Syracuse and Utica Areas

Area	Estimated Benefits (thousands of dollars)
Buffalo	578.64
Syracuse	89.94
Utica	101.74

E. Retail Shopping Center

As noted, shopping centers classified as regional centers are distinguished from those classified as community centers by the presence of at least one large (at least 100,000 square feet), major department store as the principal tenant. Community centers typically include a junior department store as the principal tenant. This distinction infers a difference between the center types in terms of the range and depth of shopping goods available, the physical size of the centers and their sales revenue experience per leasable land area. Because no characteristic other than the leasable area of the model shopping center is specified, only size is used to determine the shopping center classifications.

The 202.8 thousand square foot model center is approximately one-third larger than the median size of community centers nationally in 1969, but less than half the median size of regional centers nationally in that year (see Table 19). The relatively large disparity between the size of the selected retail center and the median size of regional shopping centers in 1969 is the only justification for identifying the selected center nationally as a community center.

This classification was verified in the Buffalo and Syracuse case study areas by examining the leasable area of shopping centers in those areas according to their classification as community or regional centers. The Utica area has only one retail shopping center (the Riverside Mall, 550 thousand square feet) outside the central business district, and was, therefore, excluded from the results summarized in Table 20.

The median size of community shopping centers in the greater Syracuse area is considerably less than the median size of community centers in the Buffalo area. The 202.8 thousand square foot model center falls within 0.2 standard deviations of the mean size of community centers in the Buffalo area, verifying that the model center would, by a size criterion alone, be accurately classified as a community center in the Buffalo area. Comparison with the mean community center in the Syracuse area, however, places the 202.8 thousand square foot model center outside 2.3 standard deviations from the mean, but within 1.1 standard deviations from the mean size of regional centers in that area. The classification of the model shopping center as a community center was, nevertheless, adopted for the Syracuse area, consistent with the closest median criterion used to classify the model center nationally. Evidence that the model center may be more accurately described in the Syracuse area as a regional center indicates that the benefits in terms of estimated additional revenue may be understated in the Syracuse area. The model retail shopping center in the Utica area is assumed to be a community center.

Estimates of the cumulative increases in annual sales revenues expected to accrue to the model center in each area are presented in Table 21. These estimates are based on the gross revenues per leasable area experienced nationally and in the Northeast in 1969. This revenue was ad-

justed to 1975 by the Consumer Price Index for the United States and the Northeast, respectively, and brought forward over the fifty-year life of the building according to the compounded rate of growth in sales revenues experienced by community centers nationally and in the Northeast between 1966 and 1969. The estimates of gross revenues generated by handicapped persons utilizing selected retail shopping centers differ between the national estimate and the case study estimates by (1) the median gross sales revenues per leasable area experienced by shopping centers nationally and in the Northeast, and (2) the age composition of the populations (constant national prevalence rates of chronic, mobility-restrictive impairments by age category were applied to the total population in each area to produce area estimates of the beneficiary population). The estimates of gross revenues differ among the Buffalo, Syracuse and Utica SMSA's only by the composition and size of the populations.

Table 21 includes area estimates of projected gross revenues discounted annually at 7 percent nationally and at 12 percent for SMSA's in New York State. The area revenue estimates are calculated on a 12 percent discount rate. Again, since the benefit estimates calculated are very sensitive to the discount rate selected, raising the discount rate from 7 to 12 percent for SMSA's in New York reduced total benefits in each area by approximately two-thirds. It is to be noted, on this basis, that the selection of an arbitrary rate may be critical in the comparison of the discounted benefits to costs.

Table 19: Characteristics of Community and Regional Shopping Centers:
US Median, 1969

	Community Shopping Centers	Regional Shopping Centers
Gross Leasable Area (square ft.)	153,700	530,578
Gross Sales Revenue (thousands of \$)	8,502.7	28,746.7
Gross Sales Revenue per leasable area (in \$)	55.32	54.18
Ratio: Area of Model Center to Median area of indicated center	1.32	0.38

Table 20: Gross Leasable Area of Regional and Community Shopping Centers in Buffalo and Syracuse SMSA's, 1975 (in thousands of sq ft)

	<u>Buffalo SMSA</u>		<u>Syracuse SMSA</u>	
	Regional	Community	Regional	Community
Median	525.0	211.5	362.9	118.9
Mean	574.8	189.6	366.8	110.7
Standard Deviation	255.3	66.4	149.7	39.5
Range	270.0-1100.0	93.0-270.0	149.5-657.6	51.1-183.4
(n)	10	10	11	12
Standard Deviations of Model Center From Mean Size	1.457	0.199	1.096	2.332

Source: Computed from information obtained from the Division of Research and Marketing, Buffalo Area Chamber of Commerce (Inventory: May-June, 1975) and the Greater Syracuse Chamber of Commerce (Inventory: February, 1976).

Table 21: Estimated Economic Benefits by Utilization by Handi-
capped Population of a 202,000 Sq Ft Shopping Center
1975-2024 (thousands of dollars)

	National Median Cumulative Gross Revenues	Northeastern Median Cumulative Gross Revenues
National Average	4,537.7	-
Buffalo SMSA	-	6,723.4
Syracuse SMSA	-	5,879.2
Utica-Rome SMSA	-	6,583.0

F. Public Branch Library

The benefits that would result from the accessibility of a public branch library to handicapped persons are expected to be primarily non-economic. No single type of economic benefit can be feasibly stated as a benefit uniformly accruing to all handicapped persons utilizing library services. In particular, the level and nature of economic benefits depend on the individual's motive in using the library and on the substitutions in time and resource utilization that library use represents. Attributing motives and substitution behavior uniformly to all handicapped individuals utilizing library services is, within the scope of this study, speculative. For this reason, a cost-effectiveness approach to evaluating the merits of handicapped persons able to physically utilize a library building is preferable to a cost-benefit evaluation. In particular, assuming that the accessibility of library services is a desirable goal; is the removal of architectural barriers the least costly route toward achieving that goal?

Approximately one in four persons in the community at large regularly utilizes available library services.³¹ If this same utilization rate is exhibited by handicapped persons (including use by pre-school children) the beneficiary group is at most 25 percent of the handicapped population of the area.³² This relatively small expected beneficiary population together with the possibility that library services are to some extent transportable indicates that the effectiveness of library service delivery modes other than the physical accessibility of the building itself need to be examined carefully.

Library services for the physically handicapped in New York State include the circulation of braille and recorded books (on disc and tape) by direct, free mail service to persons unable to read or cope with conventional print books for reasons of physical disability. Two regional libraries, a branch of the New York Public Library (New York City) and a unit of the New York State Library (Albany) serve the entire handicapped population of New York State, distributing machines around the state to facilitate use of the recorded material. There is no compiled evidence that this system is effective, adequate, or superior to the physical accessibility of library buildings. Moreover, cost estimates per service user are unavailable.

Some estimates of cost for an analogous library service for physically handicapped persons in Wisconsin are, however, available for 1968 and 1969; these cost figures are presented in Table 22 in 1969 dollars and inflated to 1975 levels via the regional consumer price index. Because of the differences in population characteristics and density between Wisconsin and

New York, use of these figures as an exact description of costs is inadvisable. They do, however, provide a general level of annual costs- assuming comparable service programs that is useful in comparison with the cost figure presented in this section.

Local library services for the physically handicapped available in the Buffalo, Syracuse and Utica areas are varied. The Buffalo Public Library, as does the Syracuse Public Library, offers a Bookmobile program to service neighborhoods within the metropolitan area without branch libraries. The service areas in both the Buffalo and Syracuse systems include residence facilities for the elderly and physically handicapped. The library vans run on an established schedule and are supplied with materials from the main library. In addition, the library systems in all three areas have established small libraries in selected residence facilities for the elderly, blind, and persons with motor activity restrictions. These libraries also are supplied with materials from the central libraries, and are available to residents according to an established schedule. The Buffalo Public Library retains a full time librarian to meet the needs of the physically handicapped persons in the area; approximately 25 per cent of that librarian's time is spent in community work in nursing homes and other residence facilities for the physically infirm. None of the three library systems has an operative homebound service to distribute unlimited library materials to eligible persons. The Utica Public Library discontinued such a service in January 1976; no cost estimates for this particular service were available. Onondaga County does, however, maintain a Books-by-Mail distribution system that provides Onondaga County residents with a selection of library materials. These materials are available both in printed form and as disposable recorded discs revised annually. Again, an estimate of the costs of providing the service (due to the overlap of personnel and facilities across specific duties) was unavailable.

Table 22: Average Consolidated 1968-1969 Budget for Wisconsin Library Services to the Physically Handicapped and Estimated 1975 Equivalent Cost for New York State

Project Description	Average 1968-1969 Allocation	Estimated 1975 Cost - New York State
Administration	\$7,213	\$10,696
Service Expansion	8,099	12,010
Conference and Publicity	4,735	7,022
Distribution of large-print material to seven regional library organizations	4,480	6,644
Total	\$24,527	\$36,372

Source: James C. Grogan, "'We're Normal People Like You,'" Wisconsin Library Bulletin (May-June 1969), pp. 151-152.

G. City Hall

Because the services located in a city hall building were not uniform across the case study areas, the benefits - both economic and non-economic - potentially available from the accessibility of that particular building are diffuse. Additionally, as in the case of a branch public library building, economic benefits are definable only in terms of an individual's motives in utilizing the services offered. It is improbable that these motives are in any way uniform throughout the population. A survey of the municipal services offered by offices located in the Syracuse City Hall indicated that these services are almost exclusively handled by phone or mail. Virtually all municipal services, moreover, regardless of their location among municipal buildings, are primarily performed by mail or phone. There is little evidence that the benefit level (either economic or non-economic) to be derived from the accessibility of an average building of this type to handicapped persons would be significant.

5

Cost of Removing Barriers

Estimated Costs of Removing Architectural Barriers

The costs of removing architectural barriers from the selected buildings, in terms of both the redesign of proposed structures and the renovation of existing structures, were estimated by examining a specific model building selected to provide a well-defined basis for analysis. These buildings were examined for architectural barriers and the design changes necessary to eliminate these barriers were identified. Cost estimates prepared for increased cost of construction as a national average percentage of total construction cost, assuming that the buildings were to be constructed in 1975. The cost-estimating procedure and the resulting estimates are reported elsewhere (Schroeder, et al., 1978). A regional price index (computed as a sample, unweighted average of labor and material price indices by SMSA) was applied to the national cost estimate to arrive at cost estimates appropriate to the individual SMSA's. Both national and area cost estimates for residential buildings are presented in Table 23 ; Table 24 lists the national and area cost estimates for non-residential structures.

Because of the high regional price index applicable to construction in the Syracuse area (110.0), cost estimates are consistently higher - both for redesign and renovation - in the Syracuse SMSA. The low cost of redesign/renovation in the Utica-Rome area relative to the other SMSA's in New York is primarily attributable to the relatively low-cost labor available in that area.

Table 23: Estimated Cost of Removing Architectural Barriers from Selected Residential Buildings, 1975 US Average and Buffalo, Syracuse and Utica-Rome SMSA's (thousands of dollars)

Residential Building Type	Increment to Initial Construction Cost				Cost of Renovation			
	U.S. ¹	Buffalo SMSA	Syracuse SMSA	Utica-Rome SMSA ²	U.S. ¹	Buffalo SMSA	Syracuse SMSA	Utica-Rome SMSA ²
High-Rise Housing:								
200 units accessible	90.7	95.7	99.8	94.7	549.9	580.1	604.9	574.1
100 units accessible	48.4	51.1	53.2	50.5	278.2	293.5	306.0	290.4
20 units accessible	14.6	15.4	16.1	15.2	60.9	64.2	67.0	63.6
Low-Rise Housing:								
72 ground units accessible	25.1	26.5	27.6	26.2	194.4	205.1	213.8	203.0
15 ground floor units accessible	5.3	5.6	5.8	5.5	42.4	44.7	46.6	44.3
Single-Family Detached	0.4	0.4	0.4	0.4	3.0	3.2	3.3	3.1
College Dormitory	4.6	4.9	5.1	4.8	17.6	18.6	19.4	18.4

¹Based on an index computed as the average of twenty cities.

²Based on an unpublished estimate of the Utica-Rome area price index provided by the Mohawk Valley Builders' Exchange, Utica, NY.

Source: Computed from Schroeder (1978, Table A) and the F.W. Dodge Construction Pricing and Scheduling Manual, Annual Edition #10 (NY, McGraw-Hill Co., 1975).

Table 24: Estimated Cost of Removing Architectural Barriers from Selected Nonresidential Buildings, 1975 US Average and Buffalo, Syracuse and Utica-Rome SMSA's (thousands of dollars)

Nonresidential Building Type	Increment to Initial Construction Cost				Cost of Renovation			
	U.S. ¹	Buffalo SMSA	Syracuse SMSA	Utica-Rome ² SMSA	U.S. ¹	Buffalo SMSA	Syracuse SMSA	Utica-Rome ² SMSA
College Classroom Building	2.8	3.0	3.2	3.0	10.7	11.3	11.8	11.2
Convention/Exhibition Center	14.1	14.9	15.5	14.7	108.8	114.8	119.7	117.6
Retail Shopping Center	0.1	0.1	0.1	0.1	4.0	4.1	4.4	4.1
Public Branch Library	0.8	0.9	0.9	0.9	8.3	8.8	9.1	8.7
Town Hall	0.8	0.8	0.9	0.8	2.3	2.4	2.5	2.4

¹Based on an index computed as the average of twenty cities.

²Based on an unpublished estimate of the Utica-Rome area price index provided by the Mohawk Valley Builders' Exchange, Utica, NY.

³For this building type, benefits within the case study areas were computed for structures considerably smaller than the model structure on which the cost estimates are based.

Source: Computed from Schroeder (1978, Table A) and the F.W. Dodge Construction Pricing and Scheduling Manual, Annual Edition #10 (NY: McGraw-Hill Co., 1975).

6

Benefits vs. Costs

Benefits vs. Costs: Comparisons and Conclusion

Benefit-cost analysis is a means of assessing the economic justification of a particular investment or level of investment. Whether an investment is justified, however, may depend not only on the relative level of benefits and costs, but also on whether the investment is divisible, or competing with alternative investments that may or may not be divisible, or even whether the investment is politically feasible. By not identifying a decision-maker, effective administrative constraints (such as political feasibility or a fixed budget allocation) do not indicate which particular formulation of benefits relative to costs is appropriate to the investment decision. Use of an internal rate of return to investment, a ratio of discounted costs, or the length of the payoff period (all acceptable formulations of benefits relative to costs) may yield different investment decisions as the administrative context of the decision varies.

In the following discussion, both the level of discounted benefits net of costs and the ratio of discounted benefits to costs are presented as alternative illustrations of estimated benefits relative to estimated costs.³³ The magnitude of discounted benefits net of costs provides some idea of the absolute "profitability" of the proposed investment; formulating benefits and costs in terms of a ratio clarifies an allowable error range in the estimation of costs and benefits such that the investment still yields a positive outcome. The relative positions of investments in a priority ranking differ according to the formulation used.

The levels of discounted net benefits by building type and geographic area are presented in Table 25. Because no positive economic benefits could be calculated for the redesign or renovation of a college dormitory, a public branch library or a town hall, these buildings are excluded from the calculation of discounted net benefits presented in Table 25 and the discounted ratio of benefits to costs presented in Table 26. The net benefits attributable to the removal of architectural barriers, are, in most cases, very large. Estimates of the net benefits from the renovation of a convention/exhibition center in the Syracuse and Utica-Rome areas were omitted from Table 25 because of the large discrepancy between the building sizes used to compute benefits and costs, respectively. That is, existing convention facilities in these two cities were used to compute benefits. The example facility used to compute costs, however, is much larger. Estimates for the U.S. have been omitted because revenue experience is limited (see p 51). Net benefits shown for redesign and for renovation in the Buffalo area should be regarded as very conservative.

An alternative formulation of benefits relative to costs, a benefit-cost ratio, is presented in Table 26. The figures presented in Table 26 measure discounted benefits as a proportion of estimated cost by building type and by area. Although ratios are appreciably lower for renovation than for redesign, the level of discounted benefits nevertheless ranges from seven to several thousand times the level of estimated costs. Again, the estimated ratios shown for the redesign and renovation of a convention/exhibition center are expected to be very conservative.

It is clear that considerable error may exist in the estimation of both costs and benefits without these ratios approaching unity (that is, without bringing the estimate of discounted benefits to the relatively low level of costs). The magnitude of error that would bring the estimated level of discounted benefits to the level of costs (bringing the size of net discounted benefits to zero and the discounted benefit/cost ratio to unity) is presented in Table 27. The values listed in Table 27 indicate the maximum percentage error in the estimation of benefits that would allow benefits to be at least as great as costs. In most cases, allowable error in the estimates of discounted benefits is at least 90 percent. Only for benefit estimates associated with a convention/exhibition center is the maximum allowable error less than 80 percent.

The ratios of costs corresponding to alternative means of making library services accessible to handicapped persons is presented in Table 28. Although the cost of a "homebound" - type service was estimated only as a New York State average, unadjusted to the individual case study areas by population size or characteristics, the estimated cost of redesigning a public branch library nevertheless appears to be less than the cost of operating a library service that transports library materials to the handicapped population. Renovation costs in each area however, exceed the estimated cost of a homebound service. The large opportunity for error in attributing the experience of another state to a particular area of New York State and the rough allocation of all costs to a single branch library make a more exact measurement of the costs of alternatives advisable. The figures presented in Table 28 are at best tentative estimates of relative cost.

Table 25: Discounted Net Benefits: Redesign and Renovation of Selected Buildings, by Geographic Area, 1975 (thousands of dollars)

Building Type	Redesign		Syracuse SMSA	Utica-Rome SMSA	Renovation		Syracuse SMSA	Utica-Rome SMSA
	U.S.	Buffalo SMSA			U.S.	Buffalo SMSA		
<u>Residential</u>								
<u>High-Rise:</u>								
200 units	7989.3	10744.3	13360.2	11285.3	7530.1	10259.9	12855.1	10805.9
100 units	3991.6	5368.8	6676.8	5639.5	3761.8	5126.5	6424.0	5399.6
20 units	795.4	1064.6	1323.9	1124.8	749.1	1015.8	1273.0	1076.4
<u>Low-Rise:</u>								
72 ground units	2884.9	3873.5	4822.4	4073.8	2715.6	3694.9	4636.2	3897.0
15 ground units	604.7	804.4	1004.2	844.5	567.6	765.3	963.4	805.7
Single-Family Detached	39.6	49.6	69.6	59.6	37.0	46.8	66.7	56.9
<u>Nonresidential</u>								
College Classroom Building	17793.8	13315.4	12642.5	14527.7	17785.9	13307.1	12633.9	14519.5
Convention/Exhibition Center	*	563.7	74.4	87.0	*	469.84	*	*
Retail Shopping Center	4537.6	6723.3	5879.1	6532.9	4533.7	6719.3	5874.8	6528.9

*Omitted because of severe discrepancy between structure sizes used to calculate benefits and costs or limited revenue experience.

Table 26: Ratio of Discounted Estimated Benefits to Estimated Cost: Re-design and Renovation of Selected Buildings by Geographic Area, 1975 (in units of 100)

Building Type	Redesign				Renovation			
	U.S.	Buffalo SMSA	Syracuse SMSA	Utica-Rome SMSA	U.S.	Buffalo SMSA	Syracuse SMSA	Utica-Rome SMSA
<u>Residential</u>								
High-Rise:								
200 units	89.1	113.3	134.9	120.2	14.7	18.7	22.3	19.8
100 units	83.5	106.1	126.5	112.7	14.5	18.5	22.0	19.6
20 units	55.5	70.1	83.2	75.0	13.3	16.8	20.0	17.9
Low-Rise:								
72 ground units	115.9	147.2	175.7	156.5	15.0	19.0	22.7	20.2
15 ground units	115.1	144.6	174.1	154.5	14.4	18.1	21.7	19.2
Single-Family Detached	100.0	125.0	175.0	150.0	13.3	15.6	21.2	19.4
<u>Nonresidential</u>								
College Classroom Building	6355.9	4439.5	3951.8	4843.6	1663.2	1178.6	1071.7	1297.4
Convention/Exhibition Center	*	38.8	5.8	6.9	*	5.3	*	*
Retail Shopping Center	45377.0	67234.0	58792.0	65330.0	1134.4	1639.9	1336.2	1593.4

*Omitted because of severe discrepancy between structure sizes used to calculate benefits and costs, respectively.

Table 27: Maximum Allowable¹ Error in Benefit Estimates of Selected Buildings by Geographic Area (as a percent of the benefit estimate)

Building Type	Redesign				Renovation			
	U.S.	Buffalo SMSA	Syracuse SMSA	Utica-Rome SMSA	U.S.	Buffalo SMSA	Syracuse SMSA	Utica-Rome SMSA
<u>Residential</u>								
<u>High-Rise:</u>								
200 units	98.88	99.12	99.26	99.17	93.20	94.65	95.52	94.95
100 units	98.80	99.06	99.21	99.11	93.10	94.59	95.45	94.90
20 units	98.20	98.57	98.80	98.67	92.48	94.05	95.00	94.41
<u>Low-Rise:</u>								
72 ground units	99.12	99.32	99.43	99.36	93.33	94.74	95.59	95.05
15 ground units	99.13	99.31	99.43	99.35	93.06	94.48	95.39	94.79
Single-Family Detached	99.00	99.20	99.43	99.33	92.48	93.59	95.28	94.85
<u>Nonresidential</u>								
College Classroom Building	99.98	99.98	99.97	99.98	99.94	99.92	99.91	99.92
Convention Exhibition Center	*	97.42	82.76	85.51	*	81.13	*	*
Retail Shopping Center	99.99	99.99	99.99	99.99	99.91	99.94	99.93	99.94

¹ Such that estimated discounted benefits are still greater than or equal to estimated costs.

*Omitted because of severe discrepancy between structure sizes used to calculate benefits and costs, respectively.

Table 28: Ratio of the Estimated Cost of a Homebound Service¹
to the Estimated Cost of Redesigning or Renovating
a Public Branch Library by Selected SMSA in NY State,
1975

Area	Redesign	Renovation
Buffalo SMSA	5.8	0.6
Syracuse SMSA	5.8	0.6
Utica-Rome SMSA	5.8	0.6

¹ Estimated as 1/7 of the total average consolidated budget for homebound service, NY State estimate, Table 22.

7. Summary

The opportunity for error in the estimation of benefits presented in this paper is extensive. Probable sources of error generally favor over-estimation, and, in most cases, very high benefit estimates result. The degree to which severely disabled persons moderate activity and the effect of sex, race, educational and income characteristics on the moderation of activity are not considered in these estimates. Nevertheless, it is apparent that the disabled population (particularly within the selected SMSA's) is distinct from the general population in terms of race, education and income, and that sex seems to be strongly associated with the degree to which disabled persons moderate their usual activities. These characteristics suggest avenues for refinement of the estimates in future studies.

Because indicators of the economic activity of disabled persons seem to parallel the activity of the population at large, there is no clear evidence that the primary assumption of zero utilization of the selected buildings by disabled persons prior to the removal of architectural barriers and normal utilization afterwards is valid. The benefit estimates resulting from this assumption are quite high. Considerable error in the calculation of benefits, often in excess of 90 percent, however, would not bring benefits below the level of costs.

Finally, it should be noted that the buildings selected for study are quite specific. The extension of these results to general building types must be cautious.

An evaluation of the redesign or renovation of buildings that yield no clear economic benefits (a public branch library or a town hall) is slighted in this study. In these cases, it is maintained that a cost-effectiveness approach to the evaluation of proposed investment is more appropriate than a benefit-cost analysis. The difficulty of producing cost estimates for alternative modes of service delivery, however, precludes a more extensive treatment of investment in these building types.

Endnotes

- ¹ National Center for Health Statistics, "Age Patterns in Medical Care, Illness and Disability," Vital and Health Statistics, Series 10, Number 32 (June 1966), p. 3.
- ² Bureau of the Census, Current Population Survey, Interviewer's Reference Manual, page D-6/12, cited in L.D. Haber, "Identifying the Disabled: Concepts and Methods in the Measurement of Disability," Social Security Survey of the Disabled: 1966, report number 1, (December 1967), p. 6.
- ³ National Center for Health Statistics, Series 10, Number 32, op.cit., and "Chronic Conditions and Activity Limitations," Vital and Health Statistics, Series 10, Number 17 (May 1965).
- ⁴ L.D. Haber, "Identifying the Disabled: Concepts and Methods in the Measurement of Disability," op. cit. p. 7.
- ⁵ It should be noted that the amount or kind of work that an individual deems himself capable of is a subjective measure. Considerable discrepancy may exist between physician and patient assessments of functional limitations. See, for example, Saad Nagi, "Congruency in Medical and Self-Assessment of Disability," Industrial Medicine and Surgery, Volume 38 (3), March 1969, pp. 27-36.
- ⁶ L.D. Haber, "Identifying the Disableds Concepts and Methods in the Measurement of Disability," op. cit., p. 9.
- ⁷ L.D. Haber, Ibid., p. 7.
- ⁸ It is implicitly assumed that building inaccessibility is not a significant factor in the decision to institutionalize adults.
- ⁹ L.D. Haber, "Identifying the Disabled: Concepts and Methods in the Measurement of Disability," op. cit., p. 9.
- ¹⁰ L.D. Haber, "The Epidemiology of Disability: II The Measurement of Functional Capacity Limitations," Social Security Survey of the Disabled: 1966, Report Number 10 (July 1970), p. 41.
- ¹¹ L.D. Haber, op. cit., p. 22.

- ¹² Double-counting of individuals who are both visually handicapped and limited in the specified physical activities may result in the over-estimation of the beneficiary population. Because the number of persons reporting visual impairments as the major disabling condition was only two per cent of the severely disabled population, the magnitude of error introduced by possible double-counting is necessarily small.
- ¹³ A review and comparison of data compiled on young persons in the United States can be found in John J. Dempsey, Handicapped Children and Disability: A Policy Overview Paper. Unpublished Draft, Office of the Assistant Secretary for Planning and Evaluation, U.S.D.H.E.W. See, especially, Section 3.
- ¹⁴ A realistic estimate of the useful life of an asset involves the evaluation of: (1) the pattern of use of the asset, (2) its susceptibility to obsolescence, (3) its susceptibility to wear and tear, and (4) the level of maintenance it is afforded. These variables were, for simplicity, collapsed into a uniform, fifty-year assumed useful life for all the buildings under study. For a complete discussion of the problems involved in arriving at a less arbitrary estimate, see generally, Charles W. Lamm, et. al., Accounting for Depreciable Assets. Accounting Research Monograph #1 (New York: American Institute of Certified Public Accountants, 1975), especially Chapter 5.
- ¹⁵ A private, experimental program initiated in 1973 to provide personal maintenance services to the homebound elderly in the Greenwich Village area of Manhattan, New York reported an annual personnel budget of \$85,000., including both professional and non-professional staff. The average annual caseload was approximately 182 persons, a figure that does not include referrals screened but not accepted into the program. Based on the number of elderly, homebound persons receiving maintenance services from the program, the services of personnel alone required to maintain these persons in a noninstitutionalized setting was approximately \$470 per person annually. (Phillip W. Brickner, "Home Maintenance for the Homebound Aged." The Gerontologist, Volume 16 (1), February 1976, pp. 25-29). The estimation technique used in our study assumes that these services, together with the opportunity cost of transporting personnel to the service recipient and the value of services arranged for by the program but actually provided by other public or private agencies (in particular, by the Department of Social Services in New York City) are included in the annual value of institutionally-provided services. To the extent that these services are irreplaceable by self-provided services, their value is included in the twenty per cent downward adjustment of benefits discussed in the text among possible sources of error.

- ¹⁶An additional source of variation between the average rental prices of the facility types is the amortization of buildings that are not equally valuable. If residence facilities providing personal care services are, on the average, more expensive than those that do not provide personal care services, this difference in amortization appears as a positive element in our estimation of the value of personal care services.
- ¹⁷The National Health Interview Survey, April-June 1963, identified 18.4 per cent of persons residing in nursing homes or personal care homes as "confused most of the time." 32.9 per cent of persons residing in nursing homes or personal care homes were identified as "confused part of the time." Among residents of personal care homes (between May and June 1964), 15 per cent were identified as being in an advanced state of senility; 25 per cent as being senile, but not psychotic, and 29 per cent as having other mental disorders. A downward adjustment of benefits by twenty percent reflects a conservative estimate of persons in health-related facilities unable to function independently due to their mental status. National Center for Health Statistics, "Characteristics of Residents in Institutions for the Aged and Chronically Ill, United States: April-June 1964," Vital and Health Statistics, Series 12, Number 2 (September 1965), pp. 26-27; and National Center for Health Statistics, "Prevalence of Chronic Conditions and Impairments Among Residents of Nursing and Personal Care Homes: United States, May-June 1964," Vital and Health Statistics, Series 12, Number 8 (July 1967), p. 2
- ¹⁸Actual federal expenditures directed toward the elderly by the U.S. Department of Housing and Urban Development included low-rent subsidies, direct loans for housing rent supplements, and rehabilitation and relocation payments totalling 44.1 million dollars in fiscal year 1972. 335 million dollars of these expenditures were subsidies to low-rent public housing, 15.1 million dollars were subsidies to the construction or conversion of housing restricted to the elderly and 40.2 million dollars were relocation payments. U.S.D.H.E.W., Facts and Figures on Older Americans: Federal Outlays.
- ¹⁹Among persons in the Social Security Survey requiring personal care assistance, 52 per cent were helped by their spouse, 18 per cent by persons outside their family, 17 per cent by their parents, and 11 percent by their children. The labor-related characteristics of persons giving help are not reported, nor is information on persons reporting limitations differentiated from information on persons reporting activity limitations. Mary E. Burdette, "Personal Care and Household Help Needs of the Noninstitutionalized Disabled," Social Security Survey of the Disabled: 1966, Report No. 21 (Washington: USGPO, September 1972), p. 2.

- ²⁰A study conducted among campuses of the State University of New York in 1974, concluded that only 8% of freshmen who entered in 1969 had not received their B.A. and were still enrolled in 1973. Central Staff Office of Institutional Research, Attrition and Retention of First Time, Full-time Students in Two-Year and Baccalaureate Degree Programs, Class of 1973, Report No. 7-74 (Albany: State University of New York, October 1974).
- ²¹Gary S. Becker, Human Capital, 2nd Edition (New York: National Bureau of Economic Research, 1975), pp. 216-223.
- ²²77% of all freshmen entering 4-year colleges in 1975, and 80% of all freshmen entering universities in 1975 were eighteen years of age. 93% and 85% of all freshmen entering 4-year colleges or universities, respectively, in 1975 were either eighteen or nineteen years of age. Astin, Alexander W. et. al., The American Freshman: National Norms for Fall 1975. Cooperative Institutional Research Programs, American Council on Education (Los Angeles: UCLA, 1975), p. 41.
- ²³The median expected transportation expenses of all full-time students attending a four-year college or university in October 1973 were \$100 between July 1973 and June 1974. There is no indication to what extent these expenses were attributable to residency off-campus. U.S. Bureau of the Census, U.S. Bureau of the Census, Current Population Reports, p. 20, No. 281, "Income and Expenses of Students Enrolled in Postsecondary Schools: October 1973 (Washington: USGPO, 1975), p. 15.
- ²⁴In October 1973, only 25.7 per cent of all students enrolled in four-year colleges or universities resided in a dormitory or school-owned housing. Eighty per cent of all students enrolled in four-year colleges or universities resided in private houses or apartments, boarding houses, or other living quarters outside of university-owned housing or fraternity/sorority housing, op. cit., p. 5.
- ²⁵If it is assumed that only non-handicapped persons utilize the building prior to its modifications for use by handicapped persons, the increment in gross revenues generated by handicapped persons being enabled to use the building can be calculated as:
- $$R/A \cdot A/P \cdot H = R_H$$
- Where R_H = is the increment in gross revenues attributed to utilization by handicapped persons
 R = gross revenues attributable to use by non-handicapped persons
 A = number of non-handicapped persons whose utilization generated R
 P = non-handicapped population of the area
 and H = handicapped population of the area

25(cont.) so that the increment in gross revenues, adjusted for the demonstrated utilization rate of the non-handicapped population can be stated as gross revenues multiplied by the ratio of handicapped to non-handicapped persons in the area.

26 The distinction among regional, community and neighborhood shopping centers may be summarized as follows:

The regional center provides a variety and depth of shopping goods (general merchandise apparel and home furnishings) and services comparable to a central business district. At least one major department store of generally not less than 100,000 square feet is the principal tenant.

The community center provides convenience goods (daily living needs, such as foods, drugs, hardware, and personal services) as well as shopping goods, and may include banking, professional services and recreational facilities. A junior department store or variety store is the principal tenant.

The neighborhood center provides convenience goods; a super-market is the principal tenant.

Regional centers typically have the largest gross leasable area of the three categories, up to ten times the size of the median neighborhood center and five times the size of the median community center. The Urban Land Institute, The Dollars and Cents of Shopping Centers, 1969: A Study of Receipts and Expenses (Washington: The Urban Land Institute, 1969), p. 10.

27 The Urban Land Institute, op. cit.

28 These definitions are consistent with those used by the National Center for Health Statistics, and overlap established medicaid categories.

29 Several recent cost-benefit studies have used hourly wages to reflect the earning potential of the individual, unadjusted for sickness, unemployment or leisure preferences. Because this study investigates only economic benefits, and because the individual's hourly wage may inaccurately reflect absenteeism and unemployment, total annual income better approximates individuals' annual productivity. For a counter rationale, see, for example, George E. Johnson and Frank P. Stafford, "Social Returns to Quantity and Quality of Schooling," The Journal of Human Resources, Vol. 8 (2).

30 Estimated net rent, board and transportation expenses of resident over commuter students in proprietary institutions for academic years 1974-75 and 1975-76 were \$-403 and \$-440, respectively. These figures parallel the net expense figures for private institutions in those years.

- ³¹ Graham, Earl C., "Public Library Services to the Handicapped," American Library Association Bulletin (February 1967), p. 171.
- ³² There is some indication, in fact, that 25% would be a very high estimate of the utilization rate among handicapped persons. Testimony at a Congressional Hearing prior to the passage of Public Law 89-522 indicated that only about 10 per cent of quadripalegics would utilize expanded library services. Op cit., p. 171.
- ³³ The substitution of "cost" for "discounted cost" is allowed by the assumption that there is an initial (first-period) cost of redesign/renovation, but that no future costs (such as net maintenance or accelerated depreciation costs) accrue.

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Appendix

Information about handicapped students attending four-year colleges and universities in the Buffalo, Syracuse and Utica areas is limited to the identification of students receiving financial assistance from sources whose stated objective is to aid the handicapped. These sources include the Department of Vocational Rehabilitation, the Commission for the Visually Handicapped and the Veteran's Administration. Other than verification that particular individuals were receiving financial assistance from these sources there is no available description of the exact nature or extent of the individual's handicap. In particular, there is no evidence that the individual's mobility was in any way restricted by the physical condition on which eligibility for financial aid from these particular sources was based.

In spite of this shortcoming, a count of Syracuse University students receiving financial assistance from the Department of Vocational Rehabilitation and the Commission for the Visually Handicapped during the 1975 Fall term was conducted with the permission and assistance of the Office of Sponsored Accounting at Syracuse University. The purpose of tabulating students receiving aid from these sources was to investigate the proportion and distribution of University housing residents who could be identified as in some sense handicapped. Because of the nature of the data available, this study was undertaken only as a preliminary check of the hypothesis underlying the assessment of benefits from the accessibility of dormitory housing to handicapped students in Section 3c, and was not pursued in the other case study areas. The investigation is limited only to the Syracuse area and further to the larger of the two baccalaureate degree-granting institutions within the Syracuse city limits. The residence of Syracuse University students receiving assistance from the Veterans' Administration (totalling 35 full- or part-time undergraduate or graduate students) was indeterminable from the records kept by the Office of Sponsored Accounting. Veterans' Administration assistance recipients are, therefore, not included in the distribution presented below.

Of the 133 students tabulated, 84.2 per cent were receiving financial assistance from the Department of Vocational Rehabilitation and 15.8 per cent were receiving assistance from the Commission for the Visually Handicapped during the 1975 Fall term. These students, together with the thirty-five students receiving financial assistance from the Veterans' Administration, comprised about 1.1 per cent of Syracuse University's total enrollment during that academic term.

Table A presents the distribution of students receiving financial aid either from the Department of Vocational Rehabilitation (DVR) or from

the Commission for the Visually Handicapped (CVH) during the 1975 Fall term by student status. Students receiving DVR or CVH funds were much more likely than the student population as a whole to be undergraduates (87 per cent were undergraduates as opposed to 63 per cent among the entire student population). Moreover, undergraduate DVR/CVH recipients were slightly more likely than the undergraduate population as a whole to be attending full-time rather than part-time.

The proportion of DVR/CVH recipients attending Syracuse University as graduate students was much smaller (14 per cent) than the graduate percentage of total student enrollment (37 per cent). Among graduate DVR/CVH recipients, a very large proportion (78 per cent) were attending part-time; among all graduate students registered during the Fall term, only 27 per cent were attending part-time.

Table B describes the relative proportions of DVR/CVH recipients and the total student enrollment by undergraduate/graduate status residing in University housing during the Fall 1975 term. Both undergraduate and graduate DVR/CVH recipients were more likely to be residing in University housing than were the total undergraduate and graduate enrollments, respectively. In particular, graduate students receiving DVR/CVH funds showed a notable concentration in University housing relative to the frequency of University housing residents among the total graduate student population. The greater tendency of graduate DVR/CVA recipients to be part-time students, and the expectation that full-time students would be more likely than part-time students to reside in University housing makes the concentration of DVR/CVH recipients in University housing even more distinctive.

T-statistics were computed for the graduate, undergraduate and total populations to test the hypothesis that the proportion of DVR/CVH recipients living in University housing was statistically identical to the proportion of all students living in University housing. Only graduate students showed a significantly different residence pattern. Testing the student populations together (including both graduate and undergraduate students) the housing pattern of DVR/CVH recipients and that of the entire student enrollment did not significantly differ.

This conclusion supports the primary assumption maintained in the discussion of benefits from the removal of architectural barriers from dormitory housing: that the availability of University housing is not significant in the decision of handicapped students to purchase post-secondary education in a significantly different sense than in the decision of all students together. It cannot, however, be concluded that this is a tenable hypothesis among graduate students as a selected subgroup of the entire student population, that the results are unbiased by the possible inclusion of disparate handicap types and severities, or that the experience of Syracuse University is typical

of universities nationally or in the Northeast. The absence of detailed, compiled information on handicapped students limits investigation of these caveats.

Table A: Students Receiving Financial Assistance from the Department of Vocational Rehabilitation or the Commission for the Visually Handicapped and All Students, by Student Status, Syracuse University, Fall - 1975

	Students Receiving Financial Aid from DVR/CVH			All Students		
	Number	Per cent of Category	Per cent of Total	Number	Per cent of Category	Per cent of Total
Undergraduate						
Full-time	113	98.3	85.0	9567	96.4	60.4
Part-time	2	1.7	1.5	360	3.6	2.3
Total	115	100.0	86.5	9927	100.0	62.7
Graduate						
Full-time	4	22.2	3.0	4341	73.5	27.4
Part-time	14	77.8	10.5	1564	26.5	9.9
Total	18	100.0	13.5	5905	100.0	37.3
Total students (Graduate and Undergraduate)	133	---	100.0	15832	---	100.0

Source: Unpublished data released by the Syracuse University Office of Sponsored Accounting and the Office of University Research.

Table B: Percent of Students Living in University Housing by Student Status and Selected Financial Aid Sources, Syracuse University, Fall - 1975

	Students Receiving Financial Aid from DVR/CVH		All Students		t
	Number	Per cent in University Housing	Number	Per cent in University Housing 1)	
Undergraduate (full and part-time)	115	50.4	9927	43.1	1.746
Graduate (full and part-time)	18	38.9	5905	7.5	5.056*
Total (full and part-time)	133	48.9	15832	45.9	0.694

* Significant at the 0.0001 level

1) Married students are allocated to graduate and undergraduate categories according to the relative proportions of graduate and undergraduate residents in unmarried university housing.